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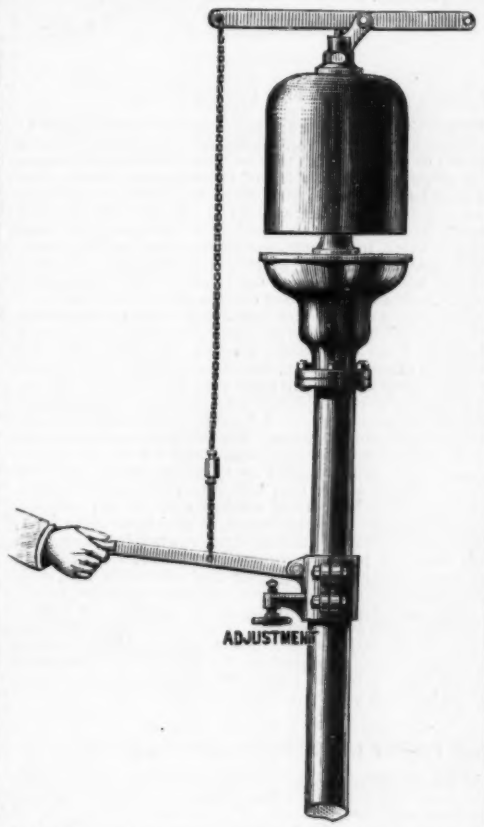
SEA TELEGRAPHY.

By W. H. Bailey.

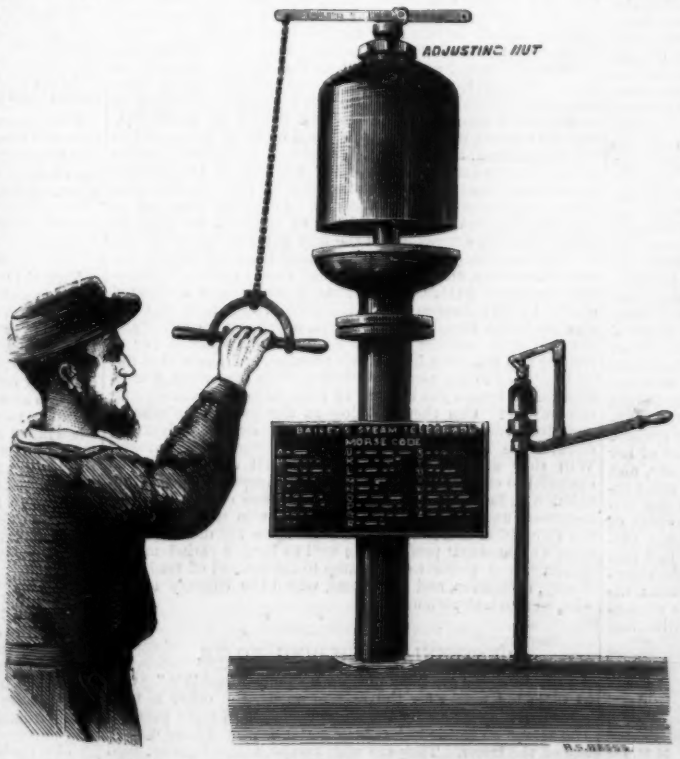
To communicate by signal is a practice of considerable antiquity, but the time at our disposal will only permit of a very brief reference to some of the early means by which people, separated by distance, have been able to communicate with one another. The prophet Jeremiah exhorts the children of Benjamin to set up a sign of fire; and in profane history we have fires, beacons, and torches often alluded to. Agamemnon communicated with his Queen by means of beacon-fires on the mountain-tops. Again, a very ingenious telegraph is described by Æneas, who lived in the time of Aristotle. It consisted of two tubs, marked inside to indicate the depth of the water, and furnished with small taps. The tubs were filled with water and placed on distant hills in charge of men with torches. Upon the elevation of a torch twice, both taps were started simultaneously, and the water, of course, ran away. But the moment a torch was elevated by the sender of the message the taps were stopped. Now, supposing that each inch of water signified a particular message, it will be seen how, by permitting the water to fall to any given level, the message indicated by that level would be conveyed. This system must have been adopted from the Clepsydra, or water-clock, which indicated the time of day by the height of water in a similar way. The ancient inhabitants of America would seem to have had communications of a similar nature. The use of torches and beacon-fires by night would naturally lead to the use of the semaphore by day—including under this designation flags or wooden erections with wing pieces or circular plates, such as are in general use to-day on railways. The semaphore was brought into celebrity in France by three brothers named Chappe, who, by means of wing pieces attached to the ends of a bar of wood, were able to make a great number of combinations. To Claude Chappe the happy idea first occurred, but he paid the penalty of being an inventor in those days, since his first instruments were destroyed by the ignorant populace. Nothing daunted, however, he continued his efforts, and when by his system the first news of a French victory was sent to Paris, he and his brothers became the pride of the French people. The system soon became well known, and additions were made to it by subsequent inventors. Lord George Murray proposed his shutter telegraph in 1795. It consisted of six shutters working on pivots, and by exhibiting one or more in combination, many messages could be sent according to a prearranged code. Messages were sent by this means from London to Dover in ten or twelve minutes, and the plan was adopted by the Admiralty, and used many years. But in foggy weather it was useless, and relays of horses had to carry the news. A remarkable proof of its inutility under such circumstances was manifested when one of Wellington's victories over the French was being announced. The words "Wellington defeated" were signalled, when a dense fog came down, and the rest of the message could not be sent. The consternation in London was very great until the conclusion of the message arrived, and it was found to read "Wellington defeated the French." In the mean time, however, the navy had made but little advance, and ships could only speak each other by a clumsy system of flags by day and colored lanterns by night. Rear-Admiral Sir Home Popham, in 1801, introduced several modifications in semaphores for land and sea, and also a system of spelling by means of flags. His ideas were adopted, and the celebrated words of Lord Nelson, "England expects that every man this day will do his duty," were the first transmitted to the fleet by the new system, which was then on its trial as an experiment. Probably the greatest advance made in signalling at sea, however, has been the results of the joint labors of Captain Colomb and Major Bolton. These gentlemen have introduced a system of telegraphing at night by means of flash lights, using oil.

It is possible for vessels to speak each other in dense fogs, and under other conditions, at distances apart ranging from three miles up to at least six or eight according to the conditions of the atmosphere. The experiments made by Dr. Tyndall in May, 1873, demonstrated the possibility of hearing a sound of a definite volume at distances varying from three and a half to twelve and three quarter miles, according to the atmospheric conditions; but that on one occasion, when the wind was against the sound, it could be heard at a distance of nine and a quarter miles. I believe that it was there demonstrated that steam horns were better than whistles; these horns cost exactly five and one third times more money than the whistles. It seems from this that making a noise in the world is simply a financial problem after all.

To speak first of vessels at sea, it may be said that the most dangerous conditions under which a vessel can move are in fogs. As dense fogs invariably occur in calm weather, it will be apparent that sound telegraphs can be used with the greatest facility when there is most serious occasion for their services. The instrument which I propose to use is a large steam-whistle so designed that a pianoforte touch will give a large opening to the steam-way, and enable a percussive short or long sound to be emitted. It will be observed that the centre spindle has upon it two equilibrium valves, which are so balanced as to be affected by the lever with the greatest ease, even though there may be a pressure of eighty or a hundred pounds to the square inch on the valve faces. This arrangement makes it possible for large whistles to be worked whose supply-pipes may be three, four, five, or six inches in diameter. The bell of the whistle is adjustable in order that high or low-pressure steam may be used, and the best results



BAILEY'S SYSTEM OF SEA TELEGRAPHY.



BAILEY'S SYSTEM OF SEA TELEGRAPHY.

be thus obtained from the steam that the boiler may carry when it is at work. This steam-whistle I propose to elevate about ten or twelve feet above the head of the operator, who by means of a chain attached to the lever, and a handle, can work it and send messages by means of the dot and dash system, using either the Morse or any other code or alphabet. I prefer the Morse code for what appear to me sufficiently weighty reasons. In the first place, this code is already in use wherever the electric-telegraph system is known. Every telegraphic instrumentalist in this country, in France, America, Russia, India, Germany, or anywhere else, uses this alphabet. And further, it is fortunate that this alphabet can be either written, seen, or heard. I have not been able to make experiments of a thoroughly definite nature on long distances to ascertain as to how far sound may be sent by one of these instruments, but I believe that one of 12 inches diameter is quite capable of being used successfully through a fog for a distance of six miles. That is to say, that should two vessels get separated in a fog, they would be able to communicate with each other, supposing them both to be provided with 12-inch whistles, even should they be six miles from one another. But I have made definite experiments with whistles 6 inches in diameter, and by one of that power, sound may be distinctly heard and interpreted over a distance of three miles.

It has been proposed by Mr. Swann that whistles should be sounded by the revolutions of a drum, like an organ-barrel, and driven by a small engine. A stereotyped international code could be continually sounded in a fog, indicating the exact course of the vessel. Mr. Swann and I have endeavored to bring his invention into use at a great cost to ourselves, but it is obvious that this system would be useless unless made compulsory by the authorities.

But although I have so far called special attention to the utility of my system in foggy weather, it must have been apparent that it would be quite as useful under more favorable conditions. By this means, indeed, news could be communicated from one vessel to another as fast as a man could write, and with much greater facility than under the condition of things now prevailing. A vessel coming from a distant quarter of the globe meeting another, and having important intelligence to communicate, may do so by simply diminishing her speed, and no time need be wasted while boats are being sent with letters.

Having endeavored to show that this is the only telegraph instrument that can be used when a fog prevails, the same arguments will apply where smoke exists, and in naval warfare the admiral, standing aloof or in the thick of the fight, may so direct the manœuvres of his vessels by means of a private code as to be perfectly understood and obeyed on the instant.

A BUCKET OF WATER EXPLODES.

The Virginia (Nevada) *Enterprise* of January 12th has this story: "Yesterday morning, at the blacksmith-shop of the Vivian mine, west of Silver City, a singular and startling explosion occurred, by which two men were severely injured. It appears that a bucket of water was being thawed out at the fire on the forge. There were four men in the shop, and while one of them was in the act of lifting the bucket off the fire it exploded with great violence. The bucket was torn to shreds, and Samuel Tangie, black, smith, and George F. Oxton, miner, were struck and wounded by the flying pieces—the bucket being made of sheet-iron. The two men were cut in several places, but their principal wounds are about the legs, the direction of most of the flying pieces of iron being downward. Oxton's principal wound is on the leg below the knee, and the worst hurt of Tangie is on the ankle, where a piece of iron passed through the flesh and tore away the periosteum, or fibrous membrane inclosing the bone, for the space of an inch. The explanation of this curious explosion undoubtedly is that a giant-powder cartridge had been thawed out in the bucket, and that its sides, and probably the surface of the water, were coated with a scum of oily matter (nitro-glycerine) boiled out of the cartridge."

ON EPSOM SALTS.

Epsom Salts, or sulphate of magnesia, has been hitherto used in dyeing for three purposes.

In the first place, an addition of Epsoms to a boiling beck raises its boiling-point some degrees, which is very important for colors that have to be fixed upon wool at 212° Fahr., or a little higher. This is especially the case with aniline violet.

Secondly, Epsoms are often used on account of the sulphuric acid which they contain, since tinctorial bases, especially the aniline colors, are often more easily fixed when combined with sulphuric acid. The muriates of such bases are easily converted into sulphates in presence of Epsoms.

Thirdly, Epsoms are often used in woollen dyeing for colors that have to be milled. If a little sulphate of magnesia remains in the dyed goods, it is neutralized by the alkaline liquids used in fulling, forming sulphate of soda and carbonate of magnesia.

It is also used to weight cotton goods, which can be made to take it up to the extent of 53 per cent, and which then seem to have a good body till they have been washed.—*Beimann's Farber-zeitung.*

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INTERNATIONAL COINAGE.

A PLEA FOR A COINAGE FOUNDED OF METRIC WEIGHT.

THE following is a copy of the memorial submitted by the American Metrological Society to the International Congress at Geneva:

The international conferences which have been called to consider the question of a common and universally accepted standard of value and medium of exchanges in recent years, and the correspondence which has been carried on intermittently between cabinets for a much longer period of time, have resulted in nothing better than to establish the certainty that, while on one or two points of secondary importance unanimity among nations is probably attainable, upon the principal and vital point, without securing which all other successes are unavailing, opinions are persistently and hopelessly at variance.

The points upon which unanimity is probably attainable are: First, the adoption of a single standard metal of coinage, namely, gold; second, the adoption of a uniform alloy. After this comes the real difficulty which has hitherto resisted all efforts at solution, namely, the adoption of a standard unit of weight and of value. The nature of the difficulty is such as to limit the solutions possible to a very small number.

First. To adopt as an international unit of account, the value of some convenient coin now actually existing, with its corresponding weight in gold.

Second. To adopt a value represented by no coin at present, but of which the representative in gold shall be the unit base of such system of weights as may be adopted for international use (say the metric system), or shall bear a decimal relation to that base.

Third. To adopt a value of which the representative in gold shall be in simple, though not necessarily in decimal, relation to the base unit of the system of weights, and which shall itself be such that the coinage of the principal commercial nations may be conformed to it without very large changes of weight.

The first of these suggestions leaves us but little room for choice. The British sovereign, the American gold dollar, the French gold piece of five francs, and the German gold piece of ten or twenty marks, are all that could be presented with any claim at all to be advanced to the dignity of the international unit. Of these, only a single one has found very earnest advocates. When, in 1863, at the meeting of the International Statistical Congress, held in Berlin, a committee of that body, regarding the unification of currencies to be an absolute impossibility, contented themselves with proposing the reduction of the units to a small number, and recommended the permanent retention of the pound sterling, the dollar, the mark, and the franc, Mr. Samuel B. Ruggles, delegate from the United States, protested against the recommendation, and advocated universal unification on the basis of the French gold piece of five francs. This unit had in its favor that at that time more than seven tenths of the gold coin of Europe was founded on the basis of the franc, and there was reason to believe that nearly half the rest would soon be made conformable to that basis. The proposition, however, met with opposition, and, though pressed persistently for nine years, it has made no progress in public favor, but has rather lost. In reference to this question, the action of the German Empire in the autumn of 1871 was regarded by all parties in the United States with the deepest interest. Had it been thought expedient to fix the unit of account for the imperial currency in accordance with the value and weight of the French gold franc, or any multiple of that value, the franc would have become, undoubtedly, the basis of the international coinage of Continental Europe; and it might have been accepted, however reluctantly, by the United States. Had the imperial unit, on the other hand, received the value of a gramme of standard gold of nine tenths fineness, it would have furnished a powerful aid to that party in the United States who are striving to obtain such an inconsiderable change in the weight of the gold dollar as shall bring the gold coinage of the country into simple relations of weight with the metric system. Germany, however, having resolved to fix the value of her mark at one third of that of a Prussian silver thaler, and computed what should be the weight of her gold coins accordingly, has added one further serious element to the discord previously existing, and has rendered the prospect of success in any attempt to merge the existing national currencies in a single one which shall be international and universal, perfectly hopeless. The following brief table, showing the actual approximation and discrepancy between the gold coins most nearly approaching each other in the currencies of the four principal commercial nations, will illustrate this hopelessness more forcibly than words:

Country.	Coin.	Weight, grammes, pure gold.	Weight, grammes, standard gold.	Value in dollars.
Germany	20 mark piece	7.168	7.965	$4.76.4
France	25-franc piece	7.258	8.065	4.82 4
Great Britain	Sovereign	7.322	*8.136	4.86.5
United States	Half-eagle	7.523	8.359	5.00.0

This untoward state of things, however, deplorable as it may seem, need not discourage the attempt to establish a coinage which shall be international. A unit of value may be fixed on for the international coinage, in accordance with the second of the principles laid down above—namely, by giving the representative coin the weight of one gramme, or of ten grammes, of standard gold. This coin and its multiples or sub-multiples would have certain positive values determinable in the denominations of the several national currencies; and should they be made a legal tender according to their values for the payment of debts in all countries, they would subserve most of the substantial ends which could be secured by the adoption of a single currency to the rigorous exclusion of all others.

Let the new coins be issued without any other denominational stamp but their weight in grammes, the reverse being distinguished by any suitable device of general significancy, and there can be little doubt that they would soon be received with favor and employed in local transactions interchangeably with those of the local coinage.

An international coinage founded on metric weight, and made legal tender in all countries, will by degrees make itself familiar to all the world. Its advantages will become daily more and more apparent as the old local coinages wear out, the necessity of replacing them will be less and less felt, but their places will be supplied by increased numbers of the metric coins, till at length all nations will slide insensibly into one common and universal system of currency.

FREDERICK A. P. BARNARD,
President American Metrological Society.

* This is the weight of the sovereign reduced to the standard of nine tenths alloy.

FISH AT THE CENTENNIAL.

A CIRCULAR, sent by the Massachusetts Commissioners to the fishermen of that State, asking their assistance, indicates the kind of display which may be looked for in that section. It is proposed that live fish of the following named varieties shall be exhibited in glass aquaria, lighted from above, the specimens to be male and female, of average size and beauty. There will be two aquaria containing cod of various kinds, haddock, hake, cusk, and lobster; one aquarium containing mackerel, herring, alewives; one containing halibut, gray and white, with turbot; one containing sharks; one containing horse-mackerel; one containing dogfish; one containing swordfish; one tank containing seals; one aquarium containing smelts, sunfish, etc.; one containing salmon and salmon-trout; one containing bluefish and black bass; one containing cunners or perch, flounders, etc. In the catalogues and upon these aquaria will appear the names of the donors. Supplemental to this exhibit will be shown in cases, renewed from time to time, as required, industrial and commercial representations of our fisheries. For this purpose, in part, are wanted the following things, due credit for which will be given to those who furnish them: Codfish, various kinds—George's Bank, shore, etc.; haddock, pollock, cusk, hake, specimens of each; halibut, smoked and salted; salmon, smoked and pickled; pickled trout, in kits, with glass tops; herring and alewives, smoked, etc.; mackerel, in kits, with glass heads, as prepared for market, Nos. 1, 2, 3, 4, and in cans hermetically sealed; tongues and sounds, in kits, glass tops; clams and oysters, in cans, jars, etc.; herrings, salted, in kits, glass tops; swordfish, in kits, glass tops; bass, in kits, with glass tops; bluefish, in kits, glass tops; lobsters, in cans, hermetically sealed, with sample in glass; fish-oils of various kinds; whalebone, whale ivory, spermaceti candles, etc., nets, fish-hooks, fish-lines, harpoons, spears, trawls, bait mill to prepare bait, lobster-pot, etc.

THE PROFIT OF INTERNATIONAL EXHIBITIONS.

IN a letter advocating a Government appropriation for the Centennial Exhibition, the Hon. John Jay makes the following pertinent remarks:

"The President in his late message says of the Exhibition: 'The value in bringing to our shores innumerable useful works of art and skill, the commingling of the citizens of foreign countries and of our own, and the interchange of ideas and manufactures will far exceed any pecuniary outlay we may make.' In this view the President is fully sustained by the experience of other countries. The result of the Exposition at Vienna, as described in the Vienna dispatch of January 30, 1874, read to the Senate by the Hon. A. A. Sargent, of California, appeared to tell another story when it simply stated the deficit at 13,000,000 florins, or $7,000,000. But the omitted paragraph, which will be found the most important, showed, in the language used by the Finance Minister of Austria, his Excellency's view of the gain to the Empire in giving to its art industry a stimulus and prestige and opening new markets for its productions. Look, for example, at the first International Exhibition of England in 1851, to which this will correspond as the first national affair of the kind in America. In 1850 the exports of England were £131,000,000 sterling, and in 1853 they had risen to £214,000,000—an increase of $415,000,000. That increase was attributed chiefly to the influence of the Exhibition, and from it came also the South Kensington Museum, which, by educating and developing the artistic taste of England, has enabled her to recover and maintain her artistic prestige, and has added untold millions to her yearly revenues. Can American statesmen safely ignore the bearing of such facts upon our coming celebration? Can they, looking at the present dulness of American trade and the languishing of certain industries, discard the lessons taught by the experience of Europe? Will they assume that, apart from that art-education so essential to enable us to compete with Europe which the Exhibition at Fairmount will afford to millions of our countrymen who, unable to travel, could obtain it in no other way, the Exhibition will not open new markets for our coal and metals and natural products, as well as for our varied manufactures, and prove to be a step to the revival of trade, industry, commerce, and confidence, which the country awaits with so much impatience?"

CENTENNIAL BUILDING NOTES.

THE Japanese are busy putting up their "yashikis." One of them is a bazaar for the sale of goods, the other a two-story dwelling-house for the accommodation of sixty persons. The workmen reside in a one-story temporary house on the site of the latter. They are wide-awake, active fellows, well capable of taking care of themselves. Their manner of working attracts much attention. In planing a board the tool is drawn, not pushed. In sawing, the feet perform a large part of the work, holding the board while the hands keep the saw moving. They mortise as much as possible, and avoid, so far as they can, the use of nails. The buildings have heavy red-tiled rooms, whence their name. Both are of ornate design, and will have handsome porticos. They will be surrounded by a Japanese garden, the flowers for which will be shipped soon, with gardeners to attend to them.

THE plans for the addition to Memorial Hall have been adopted, and the contract for the erection of the building has been awarded. The structure will stand about a hundred feet in rear of Memorial Hall, which it will resemble in general appearance. It will be of brick, overcast with cement, and painted to represent granite. It will be 350 ft. long by 186 wide, and will cover about an acre of ground. The interior walls, 18 ft. high, will be fireproof, and the building will be amply lighted from above. The ground plan presents two large galleries, 101 ft. 6 in. by 40 ft., and twenty-four galleries, 40 by 40 ft., with a passage-way, 20 ft. wide, running the entire length of the building. The last, with a shorter passage-way, will be used for the exhibition of water-colors.

THE brewers promise to put up one of the finest and most completely equipped of the trade buildings. The money required, $30,000, has been subscribed, and a plot of ground about 300 ft. square has been selected near the main building. Here the brewers will establish their headquarters, and probably set up a model brewery. If this is done it will present a new feature for exhibitions of the sort. At no other world's fair has there been any thing of the kind. No beer will be made, yet each step of the entire process of beer-making will be represented.

THE plans for the Pennsylvania State Building contemplate a Gothic structure, having a front of 105 ft. and a depth of 69 ft. It will stand at the corner of Belmont and State avenues. The main entrance will be surmounted by a large tower, and there will also be towers at the ends. A handsome effect is anticipated.

MICHIGAN promises to have a fine building, which will represent the resources and the constructive ability of the State. The structure and all the fittings and adornments will be of Michigan material and workmanship, contributed by the builders of that State.

THE pavilions of Ohio, New-Jersey, Kansas, and Indiana are well under way.

THE office of the United States Centennial Commission is under roof. So is the boiler-house at the east side of the middle extension of Machinery Hall.

THE Spanish building, of which the foundations are laid, will stand on the Avenue of the Republic, between Machinery Hall and the T. A. B. Fountain.

THE Centennial Post-office will occupy 2100 square feet in the Government Building. It will be a working post-office, with every facility for the reception and delivery of mails. Nearly 1600 ft. of space have been devoted to the General Post-office Department, for a display of stamps, maps, and so on. There will be an envelope machine in operation, manufacturing envelopes and stamps of special design.

THE United States Government will also erect on Belmont avenue, near State avenue, a signal and weather station; and near the end of Machinery Hall, a fortified block-house of the sort used in the Indian country.

AMONG the other minor buildings contemplated or in progress, are one for the exhibition of files of American newspapers and for the headquarters of journalists; a building for the exhibition of models of Paris and Jerusalem; a building for the exhibition of the products of the Liberty Stove Works of Philadelphia.

LAUBER'S restaurant, near Horticultural Hall, is nearly finished. It is of ornamental design, and as it stands near the children's play-ground, it is proposed to make it a permanent feature of the Park.

THE French restaurant is rapidly going up, and the American and Southern are nearly finished.

THE bridge over Lansdowne Valley, the deep ravine north of Memorial Hall, is in process of erection. It consists of twelve spans, and has a total length of 515 ft. The roadway is 60 ft. wide, and the two sidewalks 10 ft. each. The foundations are of masonry, and the trestles of timbers are united so as to form a strong and rigid system. It is expected that the bridge will be a favorite resort, as it commands a fine view of the river and along the ravine. The floor at the centre is 68 ft. above the ground.

THE narrow-gauge railway on the ground is finished, and cars will soon be put on. The road has a double track, and makes the circuit of the grounds, passing close to every building of importance. The cars will be drawn by dummy-engines. Fare, five cents.

EXHIBITION NOTES.

THE old "John Bull," the first locomotive ever run on the Camden and Amboy road, is being put in running order, and will be sent to the Centennial. It was built by Robert Stevenson over forty years ago, has 12 in. by 20 in. cylinders, one pair 4½ feet drivers, and weighs about 12 tons. The oldest locomotive in the possession of the New-York Central and Hudson River Railroad Company, that remains as it was originally built, is now stowed away in the round-house at Schenectady. It can be moved by steam, but is not safe to use, having been condemned a year ago. It weighs some thirteen tons, and was built by Norris, of Philadelphia. There are at the West-Albany shops two of the driving-wheels of the "De Witt Clinton," the first American locomotive-engine that run upon rails in the State of New-York. It is proposed that the old engine at Schenectady be fitted up with the "De Witt Clinton" driving-wheels, and sent to keep the "John Bull" company.

THE allotment of space for the exhibits of foreign countries in Machinery Hall has been begun, and spaces, designated by different colored lines, have been marked for different countries in the eastern section of the building. The following are the spaces as thus far allotted: Germany, 10,757 square feet; France, 10,139 square feet; Belgium, 9375 square feet; Canada, 4300 square feet; Brazil, 4000 square feet; Sweden, 3168 square feet; Spain, 2448 square feet; Russia, 1500 square feet; Austria, 1536 square feet.

THE customs officers have begun their labors, many of the exhibits being received in sealed cars. As shipments of goods from abroad are coming in rapidly, these officers will soon have their hands full. The Secretary of the Treasury has decided that Section 6 of decision 2432, November, 1875, provides for the transportation of merchandise destined for the International Exhibition at Philadelphia by a duly authorized and bonded route, a route authorized and bonded expressly for the purpose of transporting goods to the Centennial Buildings,

and is not to be construed as authorizing the transportation of such goods over and other than one bonded specially for that purpose.

THE Kindergarten lately called for by Director-General Goshorn has been provided for by the women of the country, as a part of the Women's Exhibition.

IT is expected that the State of Pennsylvania will provide for the erection of a common-school building.

PARTIES residing in this country, who are agents for articles manufactured in foreign countries, have made applications to the Centennial authorities for the privilege of exhibiting such articles in the United States Department. This is contrary to the regulations of the Commission. All articles of foreign production must be exhibited in the department set apart for the countries in which they are made, and must come through the commission appointed by that country.

ANOTHER man has been wasting his time. He lives in Worcester, Mass., and has spent the leisure hours of two years in constructing a checkerboard, which he proposes to exhibit as a specimen of American foolishness. It is composed of thirty-eight kinds of wood, in 3843 pieces, and one side is for the American game and the other for the French, in which sixty checkers are used. Small drawers for the pieces are at each end.

MR. JOHN HATCH, of California, has collected between 12,000 and 15,000 specimens of precious ores in various parts of the world, and will exhibit them at the Centennial.

FLOOD & O'BRIEN, the managers of the consolidated Virginia and California mines, have announced that it is their intention to send the entire product of those two mines for the month of May next to the Centennial Exhibition. It will amount to $10,000,000 in ore and 150 tons of gold and silver bullion. Fifteen cars will be required to carry the precious cargo.

THE Central Pacific Railroad Company proposes to exhibit a large collection of marbles, granites, slates, and other valuable stones, with specimens of all the ores of the Pacific Coast; also samples of all the woods, cereals, shells—both fossil and those belonging to the present geological era—and many other natural products of the West.

MR. J. G. SWAN, who is collecting curiosities in the Northwest for the Centennial Exhibition, has brought from Alaska to Portland, Oregon, a column, 30 ft. long and about 4x4 ft., carved with immense heads of Indians in various postures.

MORE than one hundred of the students of the Massachusetts Institute of Technology have signified their intention of visiting the Exhibition. The company will probably leave Boston the first week in June, and will camp in or near Fairmount Park, and, if desirable, the classes in the several departments will visit the building in company with the professors, thus affording extra advantages for scientific work.

THE Illinois State Industrial University has raised the amount apportioned to it as its quota of the $10,000 for the State, to be used in exhibiting its educational work at the Centennial.

AN International Medical Congress will meet in Philadelphia on the 4th of September, and hold a five days' session. The morning sessions will be devoted to general business and the reading of discourses, the afternoon to the meetings of the sections, nine in number, covering the whole ground of medicine and surgery. The language will be English, but not to the exclusion of any other tongue. Delegates are expected from many foreign countries.

MAINE has made all arrangements for the exposition of her material and industrial products at Philadelphia. Twelve hundred feet of space has been set apart for textile fabrics. Lewiston will furnish three fourths of this display. A full show of granite, slate, iron, felspar, and other peculiar deposits of wealth, will be made.

A CONCESSION for a banking-office on the grounds has been granted to the Centennial National Bank, a corporation just organized. Its president is E. A. Rollins, formerly United States Commissioner of Internal Revenue.

THE catalogue of German exhibits has been received. Exclusive of works of art, it comprises 1033 exhibitions, seventeen of them collective. The number of exhibitors in the several departments are as follows: Books, prints, etchings, etc., 136, including the production of the most famous German houses; mining products, in which are included every thing made of the metals, such as cannon, locomotives, and also the displays of the Prussian government works, 18; stone, cement, etc., 24; metal wire screens, etc., 12; chemical products, 40; glass, china, and clay ware, including an extensive lot from the royal Prussian works at Berlin, 25; furniture and household goods, 30; philosophical and optical instruments, 25; musical instruments, 35; paintings in oil and decorative art, 50; machinery, 75; wines, 87; toys, fancy goods, and notions, 35; steel and hardware, 14; sewing machines, 5; leather, 16; tobacco and cigars, 15; hops, malt, and beer, 95; cloth goods, 23; gold and silver ware, 50; cotton goods from the department of Gladbach, 15; silks and velvets, 15. The great house of Gephardt & Co. will take 400 feet longitudinally for a display of satin goods. Then there are many miscellaneous exhibitions, such as of woollen, linen, and white goods, laces, needlework, embroidery, watches, clocks, grains, seeds, carriages, axes, shovels, etc.

THE Swiss, who have announced their participation in the Exhibition, are divided among the following branches of trade: Chemical products, 20; hosiery, 16; silk manufactures, 19; embroideries, 24; plaited straw work, 16; extracts and other preparations (condensed milk, for example), 8; watch and clock work, 41; watchmakers' instruments, 10; scientific instruments, 5; typography, 19; photography, 9; edible preparations, 8; leather, 2; liquors, etc., 14; architecture and civil engineering, 58; sundry others, 24. Total, 414.

THE Belgian Commissioners will arrive in this city at the latter end of February, bringing with them a detachment of six soldiers from the artillery of Belgium, men competent to assist at carpentering if their services are required. The president of the commission, Baron G. de Woelwent, will be here to attend the opening ceremonies of the Exhibition. The members of the commission are Count d'Ouetrement, director-general; Mr. J. Van Bree, chief of the Fine Art Department; Mr. J. Gody, chief of the Bureau of Public Works.

THE British government has consented to defray the expense of transporting works of painting and sculpture contributed by British artists to the Exhibition, and the committee of British artists write to the Pennsylvania Academy of Fine Arts that "there is now reason to hope that artists and owners of pictures in England will send contributions to Philadelphia which shall present a fair and worthy idea of the state of British art, and enable it to take its due and proper place in the estimation of the American public."

THE French and German book trades will be very fully represented at the Centennial Exhibition, and their displays will be among the most noticeable contributions from those countries. As in the case of the American trade, the displays will be collective, grouped together under plans prepared by the architects of the respective trade associations.

NOTICE has been given to the artists and art societies in Brussels that all works intended for the Centennial Exhibition must be ready by the 5th of February, and that the government will pay railway charges from other places to that city. On February 10th they will be examined by a commission, and all that are accepted will be shipped from Antwerp by the Red Star line.

RODERICK WILLIAM CAMERON and Dr. R. Forbes, of New-York; Sir Daniel Cooper, of London, and George Russell, of Scotland, have been appointed Commissioners to the Philadelphia Exhibition for New South Wales. Three hundred tons of goods from Australia and the neighboring colonies have been shipped; also eighty-seven cases from the Cape of Good Hope.

INFORMATION has been received at the State Department that the government of Chili has appointed a second commission to act in concert with the first. The members are Messrs. Rafael Torrain, Maximiano Etrazurz, Ignacio Domekyo, Armando Phillippi, Francisco Solano Asta Burnago, Eugean Fizuera, and Lauro Barros.

THE CENTENNIAL APPROPRIATION.

THE government appropriation of $1,500,000 for the advancement of the Centennial Exhibition was passed January 25th, by the House of Representatives. Of the action of the Senate and the President, there has never been any doubt. By this national recognition, not only is the risk of financial embarrassment done away, but also the objection of many, that the Exhibition was a private, local affair, having little or no claim upon the patriotism of the people as a whole.

This effect of the action of the House was happily illustrated in the editorial columns of the *World*, one of the ablest of the opponents of the measure, the morning after the bill was passed. After reviewing the oft-repeated arguments against an appropriation in aid of what had been, from its point of view, a private speculation, our contemporary sinks the past and calls, on behalf of the Exhibition, for the cordial and unanimous support of all classes. "Whatever may have been the case before, the character of the country is now committed to the work. Let us all, therefore, with one accord, resolve that we will do our very best, each in his sphere, either by personal effort or by just, generous, and impartial supervision of the efforts of others, to make the enterprise a success in the highest and best sense."

This, we are happy to believe, is an index of a general change of feeling toward the enterprise on the part of many who have hitherto actively opposed or quietly stood aloof from what they have been pleased to style the Philadelphia show.

FRENCH ACADEMY OF SCIENCES.—DECEMBER.

On the Organic Elements considered as Electro-motors.—By M. Becquerel. This note reports the results of experiments made to determine the resultant of many electro-capillary couples placed side by side, and of which the currents are directed in different directions. If the electro-motive force of these different couples be sought, the difference between the sum of the currents traversing in one direction and the sum of the currents passing in the other, appears equal to the intensity of the electro-motive force obtained by placing the two electrodes at the extremities of the electro-capillary battery. This force is then none other than the resultant of the electro-motive forces furnished by the couples placed parallel and consecutively.

It is shown by the conclusions reached that the interior of a muscle is negative, which indicates that there is oxidation at the interior and reduction at the exterior, and that all organic bodies appear to be formed, so to speak, of an indefinite number of electro-motors, which probably intervene in the production of the phenomena of nutrition.

On the Examination of Wood Petrified by Subcarbonate of Lime in a Roman Well.—By M. Chevreul. That which is called petrifaction of a solid of organic origin comprises two distinct epochs—when it is complete, that is to say, when nothing organic remains in the petrified solid. The first complete epoch comprises the total occupation of all the interstices and pores by the matter dissolved in a liquid, in order to fix it chemically by affinity on the solid. The petrifaction of this first epoch does not represent the form of the solid, but that of its pores and interstices. The second complete epoch comprises the duration of the total disappearing of the organic matter itself, and its replacing by an inorganic matter which penetrates in a liquid form. It is this last matter which represents the form of the organic substance. The course of petrifaction, thus described in the abstract, comprises every imaginable case which can be found in nature.

On New Poisonous Principles in Spoiled Indian Corn.—By M. Lombroso. A tincture of damaged Indian corn, very different from that obtained with the grain when in good condition, contains an oil of a resinous character soluble in alcohol. In the air, it is precipitated by benzine. It has a bitter odor, and when administered to cocks during several months, it has caused choreic movements of the head and of the comb in particular. Besides this substance, a red material has also been extracted, which causes death, accompanied by convulsions, very rapidly in chickens and frogs. The effects denote the presence of a principle analogous to that of strychnine. This substance, dissolved in oil, has been successfully used by M. Lombroso as a specific (externally applied) for inveterate skin diseases, eczema, and psoriasis.

Celestialite.—This is the name given by Prof. J. Lawrence Smith to a crystallized sulph-hydrocarburet found in the graphite in the interior of meteoric iron, and communicated by him to the French Academy.

On the Process of Magnetization called the Double Touch.—By M. Gaugain. It would appear that when a series of rubbings are executed on a bar, the magnetization corresponding to a determinate portion should be stronger in the case where the friction terminates on that part than in the case where it terminates at other points. This conclusion is not justified by experiment. The author has found that, after a series of passes directed from the extremities of the bar to the middle, the magnetization of the middle portion was notably stronger than after a series of passes in the opposite direction; but he has not found that the direction of the rubbing has an appreciable influence on the magnetization of parts in the vicinity of the extremities of the bar, and as the magnetic intensity of the poles depends exclusively on the magnetization of these parts, it appears indifferent as to the point at which the friction terminates.

On the Temperature of Upper Atmospheric Regions.—By M. Mendeleef. By comparing the data of observations with those theoretically deduced, the author concludes that in the upper regions of the atmosphere there exists a source of heat, for the temperatures observed are constantly higher than those calculated. This source is without doubt found in the aqueous atmospheric vapors.

On the Transparency of Flames and of the Atmosphere.—By M. Allard. The burners of the lamps employed in the French lighthouse service have diameters increasing from 1.1 to 4.8 inches, and carry from one to six concentric wicks. In measuring the luminous intensity of the flames produced, it is found that the intensities augment a little slower than does the consumption of oil, and if the former be considered in connection with the sizes of the flames, it is found that the intensity per square centimeter of apparent surface increases, while the intensity per cubic centimeter of volume diminishes in accordance as the diameter becomes greater. These results the author considers can not be explained except it be admitted that the transparency of the flame is not absolute.

ACADEMY OF SCIENCES, SAN FRANCISCO.

VICE-PRESIDENT EDWARDS in the chair. Mr. Edwards read a paper on the *Darlingtonia Californica*, a species of pitcher-plant found in many places on this coast, and notably among the foothills of the Sierra Nevada and around Mount Shasta. It is found in mountain meadows and around bogs, often at an altitude of 5000 feet above the sea. Mr. Edwards exhibited a number of specimens of the plant.

Vice-President Gibbons spoke of this plant, and its reputed property of digesting like animals, and thought most scientific men were now agreed that it has been demonstrated that the leaves do not possess actual digestive powers. For one, he does not believe they do, but thinks they reduce their food to a state of manure, which is then absorbed by its leaves, instead, as in other plants, by its roots. Some species of this plant, formerly used in the treatment of cases of small-pox, have been proven to have no such potency as was ascribed to them, and the practice is now obsolete.

TYING THE CAROTID FOR FACIAL NEURALGIA.

AT the last meeting of the German Society of Physicians and Naturalists, Dr. Patruban read a paper on this operation, in which he offered no theory as to the mode in which it acts, but grounded his defence of the operative measure on the results obtained. He proposes to operate in this manner when all other means have failed, and the patient insists upon relief at any cost. He himself had tied the carotid artery under these circumstances thirteen times, and had never noticed any of the symptoms mentioned as often occurring, such as cerebral congestion, vertigo, double vision, squinting, etc. The idea of the operator had been gained by the relief obtained in some cases by simple pressure of the carotid. The author added that no accidents need be feared if the operation is well done.

[Pall Mall Gazette.]

PROPAGATION OF DISEASE BY BIRDS.

THERE are few more mysterious travellers than tunes and diseases. A new tune comes out in London, and six weeks later it may be heard whistled by boys in some obscure and distant village, to which it has found its way in some manner best known to itself. It is the same with diseases, which creep over the country silently, swiftly and surely, although their means of transit baffle the skill of the most intelligent members of the medical profession to divine. A new theory has now been started, that the foot-and-mouth disease, which is so prevalent among cattle, is conveyed from one district to another, notwithstanding all the precautions taken against its spread, by birds. A wood pigeon has, according to the Elgin *Courant*, been lately shot near Elgin which has been declared by veterinary surgeons and competent medical authorities to have been evidently affected by foot-and-mouth disease at the time of its death. The body of the unfortunate bird has, it is stated, been sent to the Veterinary Department of the Privy Council office, and may throw new light on the subject.

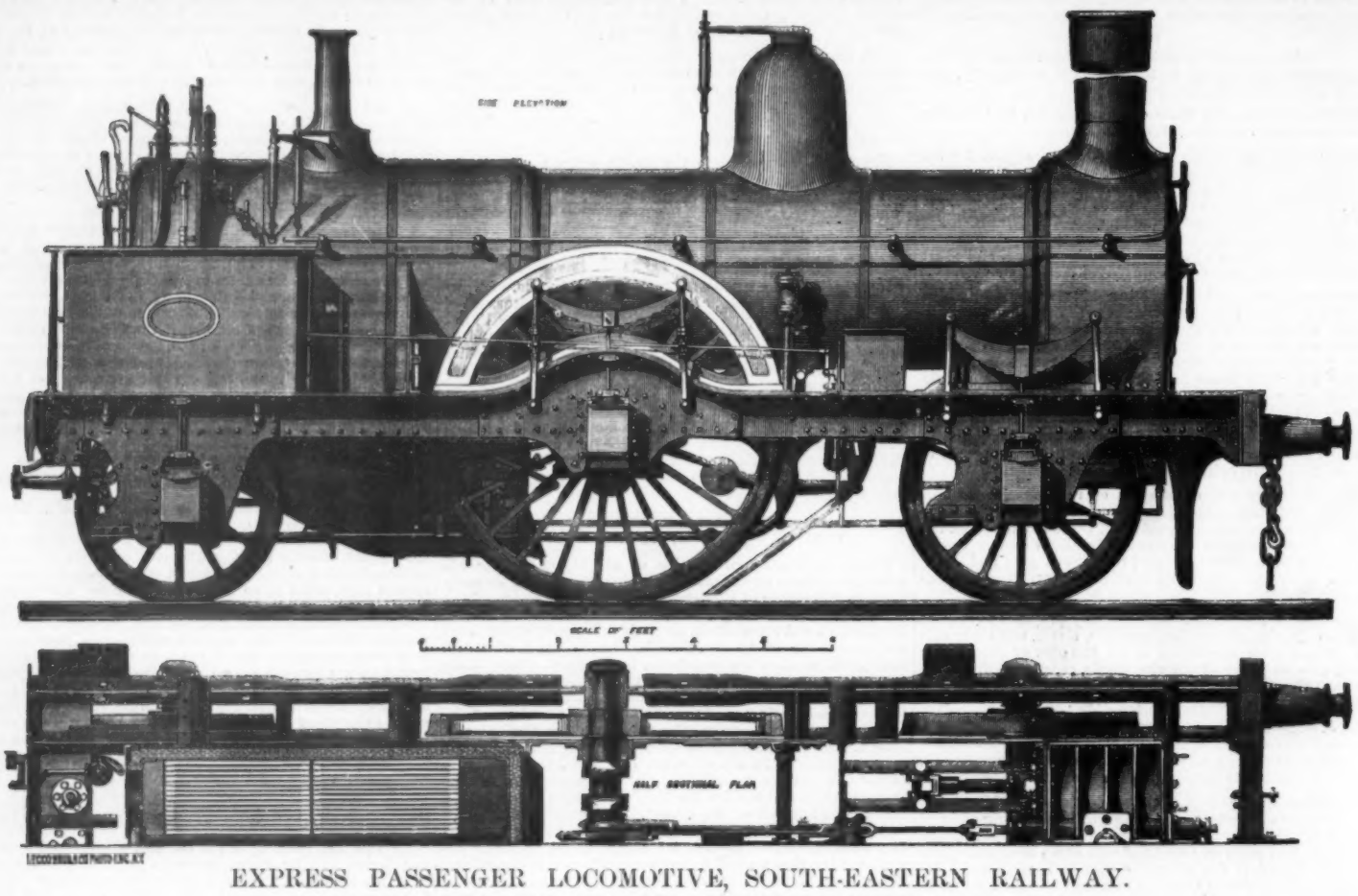
DIAMOND ROCK-DRILL.

ON the bottom of the boring rod is a steel tube, which is faced on the lower end with a number of rough uncrystallized diamonds, named carbonite. This boring tool is made to revolve with its face in constant contact with the rock, similar to a drill or cutters in boring iron or other metals. A jet of water is forced down the centre of the hollow boring rods, which keeps the face of the cutters cool, and at the same time carries the debris up to the surface. This drill can be worked at a speed of 250 revolutions per minute, at a pressure of from 400 lbs. to 800 lbs. per square inch. It will then bore granite and the hardest limestones at the rate of 2 in. to 3 in. per minute, sandstone at 4 in., and quartz at 1 in. per minute.

DIAMOND MILL-STONE CUTTERS.

THE diamonds known as carbonite have of late been much used for the cutting or dressing of mill-stones of French "burr." This is accomplished by having a diamond fixed in a small steel holder, which is worked in a straight slide fixed over the face of the stone. By means of the diamonds, the face of the stone is cut or scratched, so as to make a suitable cutting surface for grinding the flour.

M. BUCHWALDER, in a letter to M. Dumas, remarks that a recent invention of M. Mouchot for the industrial application of solar heat was virtually anticipated in the time of Numa Pompilius by priests of the Temple of Vesta, for kindling the sacred fire, should this from any cause go out. Plutarch describes the contrivance, which was a hollow vase (formed with the sides of a right-angled isosceles triangle), so arranged that when turned to the sun all the rays from the sides united in the centre. "There," he says, "they subtilize the air so strongly that they inflame it, and when any arid and dry matter is brought near, the fire seizes it, because the air by means of reflection takes the form of flame and forces it to be inflamed.



EXPRESS PASSENGER LOCOMOTIVE, SOUTH-EASTERN RAILWAY.

DESIGNED BY MR. J. I'ANSON CUDWORTH, LOCOMOTIVE ENGINEER, ASHFORD, ENG.

SOUTH-EASTERN RAILWAY CO.'S LOCOMOTIVES.

OUR engravings, which are from the *Engineer*, represent the last type of express locomotive built for the South-Eastern Railway Company, England, from Mr. Cudworth's designs.

The engine has cylinders 16 in. diameter, and a 23 in. stroke. The driving wheels are 7 ft. diameter. The fire-box is, of course, arranged for burning coal, and has 132·31 square feet of heating surface; the tubes have 973·01 square feet of heating surface; total heating surface, 1105·32 square feet.

A carefully made experiment with one of these engines, extending over 493·1 miles of running, gave a consumption of Welsh coal of 21·34 lbs. per mile, with an average load of 13·06 carriages, weighing 142·3 tons, at an average speed of 44·15 miles per hour. The tender carries 2500 gallons of water, being sufficient for the run from London to Dover without stopping.

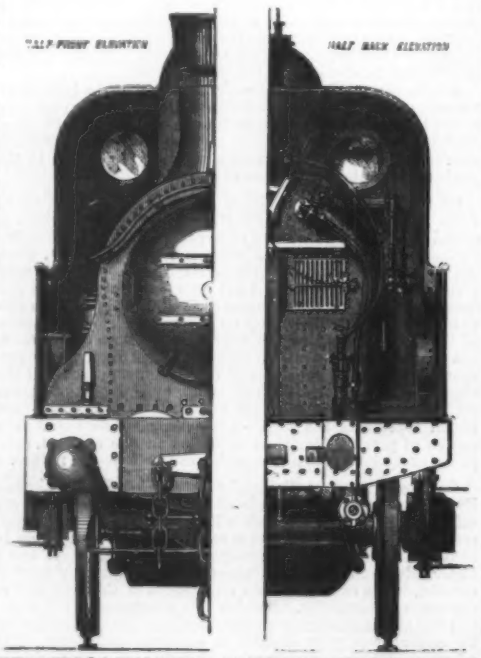
A SOLID GAS-FLAME.

THE well-known Bunsen burner has lately received a considerable development at the hands of Mr. J. Wallace, of Newcastle-on-Tyne, Eng. The flame, almost without color, was known to contain a hollow space within it for about half its length, beginning at the burner-tube. This hollow space which the Bunsen flame had in common with the candle-flame was considered an essential part of its structure, and has been so described in all the works treating on the subject. Mr. Wallace, during a series of experiments made to ascertain the amount of air that might safely be mixed with coal-gas previous to combustion, observed, that as the proportion of air was increased, the hollow space became smaller, the whole flame contracted, and the temperature became more intense. The surface of the conical space changed from a leaden blue color to an intensely brilliant emerald green, which sparkled and crackled like the flame of a blow-pipe, until (as the proportion of air still continued to increase) the hollow space disappeared altogether, and the gas and air exploded in the Bunsen tube. The form of the burner was such as to allow of an *intimate* mixture of the air and gas.

It was thus apparent that the hollow space or "zone of no combustion" depended entirely on the amount of air which was mixed with the gas previous to combustion, and it only remained to construct a burner in which the gas-jet should be able to induce the extra quantity of air, and the burner itself be so arranged that the tendency to explode or light within should be prevented. It may here be noted that a much greater proportion of air must be preadmixed to obtain a good flame from a large burner than from a small one, because the area of the flame increases at a much greater rate than its circumference. The remainder of the air, which makes up the total combining quantity, is combined with the *gas during* combustion, and appears only to unite at the lower part of the flame; the upper part being enveloped and cut off, so to speak, by its own products.

Six and one third volumes is, roughly, the total amount of air which will combine with Newcastle coal-gas, and of this 1¼ is as much as may with any advantage be mixed previous to combustion in a ½-inch burner. The remainder combines at the flame. A cylindrical cap of finely perforated iron plate was fitted on to a burner-tube 1 inch in diameter, and made adjustable to various heights. When raised to ¾ inch, gas was burned above it at the rate of 20 feet per hour, with a flame which was solid to the centre, each hole in the cap being covered by a bright green bead showing where combustion began. A 2-inch tube was next fitted up with three jets at the bottom, capable of passing 40 feet per hour at 1½-inch pressure. When lighted and adjusted, the flame proved to be as complete as the previous ones, and the proportion of air preadmixed, when measured from a test-holder, was 4 6-10ths volumes. A platinum wire stretched across the flame ½ inch above the cap became instantly white-hot for a distance of 4 inches, and the color gave no indication of any difference of temperature in any part enveloped in the flames. When the air was interrupted at the base of the burner a large hollow space immediately appeared above the cap, and the wire cooled to blackness. On again admitting the air, the wire was once more incandescent. The green beads when examined by the spectroscope give the spectrum of carbonic oxide, and they only appear in a flame which burns in the most complete manner.

The inventor of the new burner, in testing it against an ordinary light-giving burner, realized an advantage of 25 per cent in favor of the former, and as it may with safety be



EXPRESS LOCOMOTIVE—SOUTH-EASTERN RAILWAY.

turned low without lighting within, it offers at least one solution to the very difficult problem of burning coal-gas in quantity. It is already in use for many important purposes, such as heating stoves, tempering tools, warming greenhouses and baths, and raising steam for an engine to drive printing-machines.

The burner, together with numerous other apparatus and experiments, were exhibited by Mr. Wallace during a lecture he lately gave at Manchester, Eng., before the Society for the Promotion of Scientific Industry.

A COMMITTEE at Turin, acting in concert with the Italian Central Commission for the Philadelphia Exhibition, intends to send a complete collection of Italian wines, chosen from those that will best bear the long voyage.

ARSENICAL POISONING.

THE subtle and dangerous forms in which the poison of arsenic presents itself to its victims require especial watchfulness on the part of the physician. Sometimes an obscure and inexplicable case is found to be diseased by some unthought-of exposure to arsenical vapors.

Take, for instance, wall-paper. That green paper often derives its hue from Paris green, is familiar even to non-professional persons. But, as Professor Cameron remarks, in the *Medical Press and Circular*, other shades and colors are now derived from arsenical pigments. He narrates the case of a family, all of whom manifested symptoms traceable to arsenical poisoning. The Professor examined the paper-hangings. Out of seven kinds of paper, six were found to contain arsenic. No. 1, an olive-green paper, with deep green flowers and gold-like lines, contained an immense amount of arsenic in the two green colors and the gold. No. 2, a faint lavender-watered paper, contained arsenic in large amount. No. 3, a white paper with gray flowers, contained a very large amount of arsenic. No. 4, a paper with red and green flowers on a gray ground, was highly arsenical. No. 5, a dark olive-colored paper, with gilding, did not contain much arsenic. No. 6, a pale green and white paper, also contained only a small amount of arsenic, much less than was put on the lavender paper. The family had not suffered from the symptoms of arsenical poisoning until shortly after the house was papered with the above, and the symptoms disappeared shortly after they left the house preparatory to the removal of the paper.

The manner in which this poison acts on the system has lately received some additional light. Dr. H. Fleck has shown, in a series of interesting and important experiments, that there is arseniuretted hydrogen in the air of rooms the walls or the carpets of which are colored with Schweinfurth green. The dust of arsenic mechanically diffused in the air is therefore not the only cause of chronic arsenical poisoning. We mpst add the arseniuretted hydrogen gas evolved from the decomposition of the free arsenious acid existing in the green. The experiments of Fleck prove that this gas is liberated under the joint action of organic matter and moist air, and its presence is, therefore, possible wherever free arsenious acid comes in contact with organic matter.

Quite recently it has been learned that a substance is used in artificial port wine (which includes 90 per cent of that stuff sold in this country) which is, in some cases, dangerous, especially when partaken of by the feeble, delicate and convalescent. It is an artificial coloring, which, Shuttleworth says, consists of a mixture of azalin and magenta red. The aniline colors, objectionable in themselves, are the more dangerous, because they not unfrequently contain arsenic. The adulteration is detected by shaking the suspected wine (and all cheap wines are to be suspected) with an equal volume of amylic alcohol (fusel oil). If the wine is genuine port, the amylic alcohol remains colorless; but if adulterated, it dissolves out the coloring matter, and itself appears of a purple-red color.

Of the forms in which the action of this poison may manifest itself, a baffling one is arsenical paralysis.

Dr. Scolosaboff, of Moscow, has had the opportunity of observing two cases of this rather rare disease. The paralysis affected the extremities exclusively, and was more marked at the part furthest from the heart. The cases were marked by (1) alterations of all kinds of sensibility; (2) extreme muscular atrophy, with loss or diminution of electro muscular contractility, both faradic and galvanic; (3) alteration of the circulation and nutrition in the extremities, as proved by decrease of temperature, œdema, change of color, etc.

It has been remarked that gangrene of the extremities has been seen in similar cases to those recorded by our Russian *confrere*. Arsenical paralysis resembles in some respects that caused by lead, while in others it is not unlike poisoning by ergot.—*Medical and Surgical Reporter.*

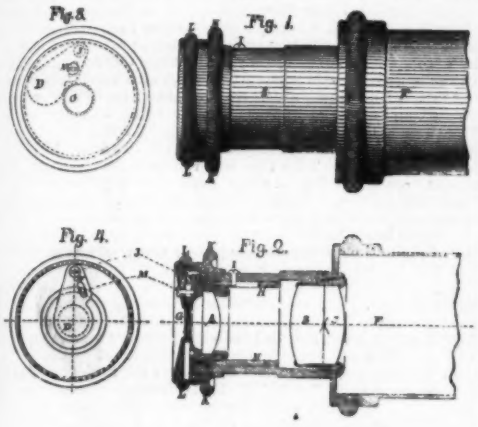
IMPROVEMENT IN EYE-PIECES FOR TELESCOPES.

By J. W. NYSTROM, Philadelphia, Pa.

CONSISTS in placing the cross-hair lines in the field-lens of the eye-piece in such a manner that they are thoroughly protected from injury; and in protecting the eye-glass from dust or foul by a cover, operated by slot motion.

I make the field-lens of the eye-piece in two pieces, and draw the cross-hair lines on one of them, after which they are cemented together with said lines in the inside, and thus thoroughly protect them from injury. The focus of the telescope is brought to the cross-hair lines in the compound field-lens of the eye-piece, and the focus of the eye-glass is also brought to the same lines, by which a clear field is obtained. The dust or foul that may settle on the outer sides of the compound field-lens is not seen through the eye-glass, because those sides are out of focus.

It is not customary, in engineering field-instruments, to protect the eye-glass from dust or foul, which may settle thereon and obscure the field of observation. In spy-glasses



IMPROVEMENT IN EYE-PIECES FOR TELESCOPES.

the eye-glass is generally covered by a slide, which incommodiously projects outside of the eye-piece during the observation, or when the eye-glass is uncovered.

In order to avoid this difficulty I make a cover, which is moved over the eye-glass by a slot motion, so that said cover is not seen during the observation.

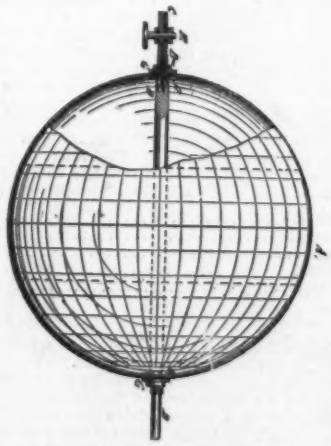
Fig. 1, side elevation of the eye-piece on the telescope F. Fig. 2, longitudinal section of the eye-piece, showing the eye-glass A, the compound field-lenses B X C, and the cover D. Fig. 3, end view of the eye-piece, showing by the dotted lines the cover D removed from the sight-hole G. Fig. 4, end view of the eye-piece with the sight-hole piece L removed, showing the cover D over the eye-glass A. Fig. 5, end view of the eye-piece as seen from the telescope, showing the cross-hair lines in the field-lens. Fig. 6, perspective view of the compound field-lens, showing the position of the cross-hair lines.

NEW GEOGRAPHICAL GLOBE.

By N. N. BROWNE, Woodstock, Ala.

THIS globe is made of rubber, and is capable of inflation with air when wanted for use. When not wanted the air is withdrawn, the membrane is folded into small space and stored. Large globes of little weight are thus produced.

A represents a globe of rubber, or other material, which will readily collapse when the air is allowed to escape. B, the poles, consisting of a hollow tube or tubular shaft, which passes entirely through the globe, but closed at one end. In this example of my invention the shaft is solid,



NEW GEOGRAPHICAL GLOBE.

having a hole, C, bored into one end, which communicates with the interior of the globe by means of the side opening D. This allows air to be blown into the interior to inflate the globe. E, stop-cock in the tubular portion. F are collars on the shaft, which keep the globe extended at the poles when it is collapsed around the shaft. G, screw-nuts on the shaft, by means of which the globe is confined on the collars F. The shaft is thus fixed in position, and when the globe is inflated it may be revolved to represent the direct motion of the earth, the inclination of the axis or poles, and from this a correct idea may be conveyed of the orbital motion, the position of the earth in relation to the sun, the cause of heat and cold, the changes of the seasons, and various other interesting phenomena in relation thereto.

WELT AND COUNTER-SKIVING MACHINE.

By S. D. TRIPP, Lynn, Mass.

CONSISTS in an improved method of hanging and operating the knife, and in a feeding mechanism of novel construction, by which much better results are attained than in machines of this character, as ordinarily constructed.

The nature and operation of my invention will be readily understood by all conversant with such matters from the following description:

In the drawing, I J are the feed-wheels, and A the knife, which is secured to the stock B by means of the clamp and screw C. The stock is provided at its heel with the socket *h*, into which the knife extends, and is pivoted eccentrically on the screw-pivot D in the arm E. The cutting or forward end of the knife is secured in the lugs F G, one corner extending into a socket or nick, H, in the lug G, and the other corner between two adjacent teeth of a small spur-wheel or rosette, *z*, attached to the inner face of the lug F. These lugs are kept in contact with the knife by means of the springs X Y being so constructed and arranged on the shafts carrying the wheels I J as to be vertically adjustable thereon, and also to have a semi-rotary movement, when desired, in the direction of the springs Y X. The cutting-edge of the knife is arranged equidistant between the wheels I J, slightly to one side of a vertical line through the axes of the same, being inclined at an angle corresponding with the work to be done, by means of the screws U V, which raise and lower the sliding bars S T, of which the lugs F G form a part. Disposed at the side of the wheels, opposite the knife, there is a feeding mechanism consisting of the bar M, provided with the tooth N, and fitted to slide in ways formed in the bed O R. This bar is actuated by the pitman K, connecting the crank-pin L and wheel J. A stationary hopper, Q, represented in the drawing as broken away at P to show the bar M and tooth N, is attached to the machine immediately over the feeding mechanism, and so arranged as to leave a space or opening the thickness of a single welt or counter only between its lower edge and the feed-bar, being also of a proper shape to contain the counters or welts to be skived or cut.

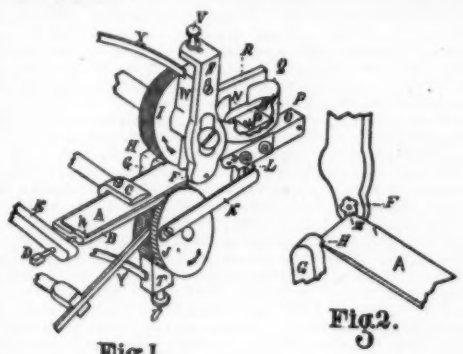


Fig. 1.

Fig. 2.

WELT AND COUNTER-SKIVING MACHINE.

The object of the stock B and clamp C is to enable a much thinner knife to be used than would otherwise be possible, thus performing the work in a better manner and greatly reducing the labor of sharpening or grinding the knife.

The rosette or wheel Z may have teeth of variable sizes, and may also be turned to bring a new notch or teeth into action when either the corner of the knife or one of the teeth become accidentally broken off, as is sometimes the case.

It will be understood that at least one of the shafts on which the wheels I J are disposed is rendered automatically adjustable in a vertical direction by means of proper springs, to compensate for the varying thickness of stock passing between them; and as it is desirable that the cutting-edge of the knife should always maintain the same relative position to the stock or piece of leather being split or skived, it will be obvious that the knife should incline less, or have its cutting-edge nearer vertical in thick than thin stock. This is accomplished automatically also by means of the lugs F G rising and falling with the wheels, and thus twisting or canting the knife on the pivot D.

In the use of my improvement the stock is first cut into proper pieces and placed in the hopper Q, in which it may be pressed down upon the feed-bar by means of a spring or weight arranged in any convenient manner.

Power being properly applied, the wheels will be caused to rotate in the direction of the arrows, actuating the feed-bar M through the pitman K, and causing the tooth N to catch and carry forward the lower welt or piece of stock in the hopper, delivering it to the wheels, by which it will be caught and forced against the knife, the arrangement of the hopper being such that but one welt can be fed forward at a time.

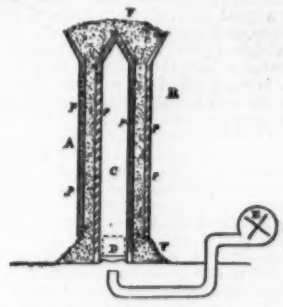
RUNNING RAILWAYS BY TELEGRAPH.

THE New-York and Philadelphia division of the Pennsylvania road is now run on the "block system." The whole line of 90 miles is divided into sections of 2 or 3 miles, each supplied with a telegraph operator and signal-man on constant duty. A frame for displaying a signal target or light is placed at the commencement of each division. When the road is entirely clear a white signal is shown. When a passenger-train enters any block or section a red one is substituted. While this is the case, no other train is allowed to go upon it. The engineer of the next following train, if he sees a red signal, must wait until it disappears, and the white one goes up. If the white light is already shown, he goes on over that block without stopping. From 4 to 8 minutes are consumed in traversing a block, according to the speed of the train, and different fast trains can follow each other at intervals of this length, which would not be possible under other circumstances. The moment a train passes off of any section, the fact is telegraphed back to the next preceding telegraph station, so that the white light may be shown and the block declared to be clear. Thus there is a constant pulsation of intelligence all along the line between the two cities, of which the passengers on the train are totally unconscious. They do not realize, as they sweep on with the speed of the wind, that their every movement is recorded by the finger of electricity, shooting back and forth with the velocity of light. Beside the numerous passenger-trains, there is a great number of freight-trains constantly in motion. These have to make their way as best they can out of the way of passenger-trains. When a freight-train is running on any block a green signal is shown, which indicates that succeeding trains may follow with caution. If the next train carries passengers, it is the business of the freight to get out of the way; if it is also a freight-train it will probably not overtake its predecessor. Some of the principal side-tracks have telegraph stations at both ends, so that no time need be lost by the train hands. There are more than 50 telegraph offices along the 90 miles of road. The arrangements usually work so perfectly that it is seldom necessary for any train to halt before entering a block. At the superintendent's office in Jersey City, a large chart is kept, upon which is marked a perfect record of the progress of each train upon the road as recorded by telegraph. If a train is a minute behind at any station, the fact is instantly known at headquarters. The conductors and engineers employed to run the trains are all intelligent and experienced men. The passenger conductors usually make one round trip per day. The active work is thus about six hours, but additional time is needed to make returns and settle up with the agents. There are three conductors and three firemen to every two engines in daily use, so that each set of men works two days out of three. Running a passenger-engine for a fast train is very exhausting.

NEW SAND AND GRAVEL DRIERS.

By S. S. DAISH, Washington, D. C.

CONSISTS of two perforated cylinders, one inside of the other, the inside cylinder to be perforated at an angle of about forty-five degrees, and inclosed with a conical top, as shown, the outside cylinder to be perforated at an angle of about forty degrees, as shown in drawings, both cylinders set perpendicularly.



NEW SAND AND GRAVEL DRIERS

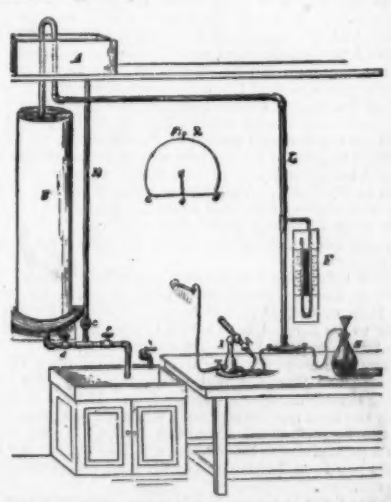
D, grate-bars; E, blower, which forces draught under the grate-bars, and the hot air striking the conical top, returns and passes down the sides and out of the perforations P into the sand or gravel, thus applying hot air directly to the material. The perforations in the outside cylinder permit evaporation.

[Mining and Scientific Press.]

APPARATUS FOR PRODUCING A BLAST OR VACUUM IN LABORATORIES.

No laboratory is complete without some appliance by means of which a strong and continuous blast of air can be produced. Since the introduction of "Bunsen's filter pump," the chemist can hardly dispense with some form of apparatus to produce a partial vacuum. In most laboratories different and distinct apparatus is used for each purpose, more or less complicated according to the means or requirements of the chemist.

The apparatus contrived by Mr. G. Henry Hanks, of this city, and which he is using successfully in his laboratory, will produce either a blast or vacuum at will; the details are well shown in the engraving.



APPARATUS FOR PRODUCING A BLAST OR VACUUM IN LABORATORIES.

The tank, *A*, may be placed in any convenient position at about ten feet above the bottom of the galvanized iron cylinder *B*, into which water can freely flow through the half-inch iron pipe, *M*. The tank is supplied with water by a ball cock, not shown in the engraving. The diameter of the cylinder is ten inches, and its height between five and six feet.

When it is required to produce a blast of air, the globe valves, *C* and *D*, are opened, and *E* closed. As the water enters the cylinder from below and rises gradually, the air is compressed, and the rising mercury in the left-hand portion of

the U tube manometer, *F* indicates the amount of pressure. When the mercury has risen one inch, the pillow cock is opened, allowing the compressed air to pass into the blast blow-pipe, *I*, the gas from the burner having previously been lighted. A powerful blue flame is produced, suitable for the requirements of the chemist's laboratory, or for soldering at the work-table of the mechanic. The tube, *L*, must be carried above the tank, as shown in the engraving, to prevent the passage of water into the air-tubes; as the pressure increases in the cylinder, the air must be graduated by turning the pillow cock. There will soon be a point reached where the resistance of the compressed air will balance the weight of the water, when the mercury will rise no higher; with this Mr. Hanks can, when there is a pressure of nearly five inches of mercury, so control the air as to produce a clear blue pencil of flame three inches long, exactly suited for blow-pipe work, or for showing the colored flames characteristic of certain elements and salts. In an instant this can be changed to a roaring intensely hot flame from five to ten inches long, suited for bending large glass tubes, or for maintaining a white heat in a platinum crucible when fusions or incinerations are desired. The decomposition of chromic iron, or fusion of silicates with alkaline carbonates, are easily made with this apparatus. To reverse this apparatus and to produce a partial vacuum, it is only necessary to allow the cylinder to partially fill with water and then to close the globe valve, *C*—the valve, *E*, being closed while the cylinder is filling. The compressed air is then allowed to escape, which will bring the mercury level in the U tube. The globe valve, *E*, is then opened and the water allowed to run into the sink; the mercury will now be seen to rise in the right-hand manometer tube. When the mercury indicates one inch, the apparatus is in the proper condition to exhaust the air in the Bunsen filter bottle, *H*, by means of which the operations of filtering and washing the precipitates may be greatly accelerated.

The apparatus may also be used as an asperator, often of great use in the laboratory. The following example is given for those who are not familiar with such appliances:

Let it be required to dry some substance at the temperature of boiling water and to determine the amount of moisture removed. A glass tube is prepared of about half an inch internal diameter and about six inches long. Into each end is fitted a good cork, through each of which a small glass tube passes, and is allowed to project outward an inch or more. A weighed portion of the substance to be dried is carefully introduced into the tube by removing one of the corks, which is then replaced, and the tube and contents weighed on a delicate balance. The tube is then connected with the apparatus by disconnecting the filter bottle, *H*, and slipping the end of the rubber tube over the glass tube projecting from one of the corks. The other end of the glass tube is then connected (also by means of rubber tubes) with two U tubes, one of which—the outer one—is filled with fragments of pumice-stone previously soaked in concentrated sulphuric acid. The other U tube is placed in a beaker of water, which is heated to boiling by a gas-burner or spirit-lamp. The pillow cock, connecting with the apparatus, is thus opened, and the air is drawn through, first the tube containing the pumice-stone, any moisture being retained by the sulphuric acid; thence through the tube which is surrounded by boiling water, where its temperature is raised to that of the water; thence passing hot and dry over the powdered substance, from which it soon removes the last trace of moisture. When this is known to be the case the glass tube is disconnected and weighed; the loss is the moisture.

As many persons are not familiar with Bunsen's filter apparatus, we will describe that portion which Mr. Hanks uses, and which is shown in Fig. 1, *H*. It will first be necessary to find a glass funnel, the sides of which form an angle of 60°. This can only be done by making a pattern and selecting by trial from a quantity of funnels. The pattern is made by drawing a circle of any convenient size and then dividing the circumference into six equal parts, drawing lines from the points to the centre; this will divide the circle into six sections, each of which forms an angle of 60°; one of these cut from thick pasteboard will form the pattern required.

Having found a funnel of the proper shape, which should have a rather long neck, make a filter of thick writing paper. This is done by folding the paper twice and then cutting off the corners, so that when unfolded it will be a circle with two folds through the centre at right angles with each other; upon being refolded and placed in the funnel properly it can be made to fit the sides closely, forming a perfect hollow cone.

A mixture of plaster-of-paris and water, rather thick, may then be prepared and poured into the paper filter while still in the funnel. When the plaster has *set* it may be removed and dried at a temperature below that of boiling water. If a piece of platinum foil, of exactly the size and shape of Fig. 2, is cut out with a pair of scissors, not forgetting to cut through from *b* to *a* at the same time, there will be no difficulty in bending it on the point of the plaster cast, into a small hollow platinum cone. This is to be placed in the funnel to support the points of future filters which would otherwise be broken by the pressure of the atmosphere.

It will be necessary to select a rather wide-mouthed bottle, shown in *H*, Fig. 1. The funnel must fit tightly the perforated india-rubber cork, the neck being allowed to enter the bottle some distance. The glass tube connecting with the apparatus does not extend below the under surface of the cork.

Before using, the bottle must be perfectly clean. The cylinder, *B*, having been allowed to fill or partly fill, the cock, *C*, is then closed, *D* and *E* being left open. Pour the substance to be filtered into a clean paper filter, placed in the funnel and supported by the platinum cone.

When the mercury indicates one inch, open the pillow cock and the filtration will proceed rapidly, the last drop passing through as quickly as the first. If the filtrate is to be saved, the cock may be removed, when all has passed through and the liquid poured from the bottle. If the filter contains a precipitate to be washed, distilled water may be poured into the funnel again and again until all soluble matter is removed.

Where there is no gas, the blowing apparatus may connect with a movable blow-pipe, and the flame may be produced by burning alcohol, oil, coal-oil, or a mixture of turpentine and alcohol.

In localities remote from business centres, where it might be difficult to procure the sheet-iron cylinder, two tight barrels may be substituted for the tank and cylinder, so that a few iron pipes and fittings only are required to construct the apparatus, which will be found very useful and almost indispensable in the laboratories of mining companies. One of the great advantages of Mr. Hanks' apparatus is its economy in the use of water; the ordinary operations for what it is required may be conducted with the expenditure of only a few buckets of that fluid.

THE GOAT AND ITS COMMERCIAL PRODUCTS.

BEING the natural inhabitant of mountainous regions, it is therefore in wild, rocky countries that the goat is chiefly reared. This animal is not well adapted to a country of enclosures, because it feeds on the twigs of hedges, and escapes over the barriers intended to confine it. But where there are no young trees to be injured, they may browse at large on the mountain brakes without expense, and in winter, when housed, are easily supported on whins or furze, cabbage-leaves, potato-peelings, and such worthless food. Farmers are generally hostile to goats, from the injury they do to trees and shrubs, but they can be kept with advantage in stables or confined. The great objection to the rearing of the goat in this country is the want of demand for its flesh, which is hard and almost indigestible. Even the kid, whose flesh is known to be very delicate and nourishing, is in no great estimation amongst us. Hence all the other useful properties of the goat are insufficient to render it an object of profitable production. Although the goat can never be as valuable here as in the dry and rocky countries of Southern Europe and Northern Africa, it does not deserve the entire neglect with which it is treated. It arrives early at maturity and is very prolific, bearing two, and sometimes three, kids at a birth. The period of gestation is five months. The female bears for six or seven years, the male should not be kept more than five. Goats emit at all times a strong and disagreeable odor, named *hircine*, which, however, is not without its uses, for if one of these animals be kept in a stable, it is affirmed that it will be an effectual preventive of the "staggers," a nervous disorder which is often very fatal to horses. In mountainous countries goats render considerable service to mankind, the flesh of the old ones being salted as winter provisions, and the milk being used in many places for the making of cheese. The flesh of the kid is highly palatable, being equal in flavor to the most delicate lamb. The wanderer on the Alps meets with frequent groups of goats, either browsing at liberty, or under the care of a barefooted boy. The poorer peasants, who can not afford to keep a whole herd, put their goats together and keep one herd-boy between them. Pastures, inaccessible to other animals, as in the steep acclivities of Berne, the Vallais, and the Tessin, are frequented by goats, which seldom mount, however, higher than 7000 feet. The mountain goat (*Aplocerus montanus*) is found throughout all the mountain ranges of North-west America, to within a short distance of the Polar Sea, if, indeed, it does not reach it. It is a larger animal than the domestic goat, which it resembles only in name and in having a beard. It is covered with long and rather brittle white hairs, beneath which a coat of very fine white curly wool lies close to the skin. The flesh, though rank, is fat and tender, and is much relished by the Mountain Indians, who also make robes, clothing, and leather from the hide. Curious dog-sleds are manufactured out of the skin covering the shank-bones, by sewing a number of the pieces together with the hair outside, which slides well over the snow. The Cashmere, Persian, Angora, and Circassian goats are one and the same animal, changed in some respects by altitude, though but little by latitude. They abound in all that inaccessible territory, and are the eating, milking, cheese and butter-making, and wool-furnishing animal of the whole country. They are finely developed for the table, much disposed to fatten, with very white and beautiful long, fine wool or curly hair, yielding about 4 to 4½ lbs to the fleece. The Thibet goat, from whose wool the famous Cashmere shawls are made, was introduced successfully into the United States some twenty years ago, by Dr. J. B. Davis, of Columbia, S. C., at that time employed by the Ottoman Porte, in experimenting on the growth of cotton in the Sultan's dominions. Dr. Davis succeeded, at vast expense, in securing eleven of the pure breed. Since that period the goat has been introduced from South Carolina into Tennessee, where it is said to thrive. The raising of Cashmere goats for their wool has also become an established pursuit in Nebraska. One gentleman has a flock of two hundred, and his success in raising them has induced many others to adopt the breeding of that valuable stock as a regular pursuit. These goats are hardy; they live and fatten on coarse food. They will winter on straw alone, and come out in good condition in the spring. The common ewe goat has from two to five lambs at a birth; the Cashmere ewe but one. They can be graded up very fast, but it is necessary to use the thoroughbred male, or as high a grade as possible, to cross with the common goat. A good common ewe goat will raise two to three one-half blood lambs well. The eight-months one-half blood ewe will drop and raise one to two lambs. This is much faster than you can grade up sheep. In choosing common goats, get the shortest-legged, best-formed you can find. There is much difference even in the common goat, and the form of the dam has much to do with the form of the future grade offspring. Parties desiring to bring up a flock should procure good, common ewe goats, in time to have the kids come in April or May. The kids are much stronger and hardier than merino lambs. A well-fatted half-blood wether goat is superior to any venison. It is probable that the day is not far distant when flocks of profitable wool-bearing goats will be seen on many of the stock farms of the United States. The fleeces of the Cashmeres are undoubtedly very valuable. The Scinde goat is a gigantic animal, with pendulent ears 22 inches long. It is used for the table and dairy, and is very similar to the Syrian goat. The Malta goat is only kept for the dairy, giving about a gallon of milk in a day. In all the malarious sections of Asia and the East, they regard cow's milk as being an exciting cause to bilious fevers, as well as to liver complaints, and hence use only goat's milk. Goat's milk is sweet, nutritive, and medicinal, and less apt to curdle on the stomach than that of the cow; it forms an excellent substitute for ass's milk. When yielding milk, the common goat will give for several months at the average of two quarts per day. Cheese procured from goat's milk is much esteemed in the mountainous countries, after it has been kept a proper age. The goat is common in China, especially the species without horns. The feet of the wild goat are used there to make a gelatine much esteemed. The blood is sometimes employed instead of that of the deer to heal wounds or contusions.

In Portugal and some other countries the goat is used as a beast of draught for light burdens, and even in England a child's chaise drawn by a goat is not an unusual sight. The hair of the goat may be shorn, as it is of some value, making good linseys, and that of the Welsh he-goat is in great request for making white wigs. Ropes are sometimes made from goat's hair, and are said to last much longer when used in the water than those of hemp. Goat's hair, from the tanneries, sells at about 3½d. per pound, and white at 6d. It is used for making mops, yarns, coarse blankets, etc. In Bagdad there is a good trade carried on in coarse goat's hair, ropes, twine, yarn, tents (of which some 5000 or 6000 are imported yearly from Persia), and soft goat's-hair cloth called tiftik. The women knit socks with the yarn. The sacks most commonly used about Adrianople, in the transport of grain, are made by the natives from goat's-hair cloth. They can be had at 10d. to 1s. 3d. each, large enough to carry four bushels. Some Bulgarian villages, Otlouhioi in particular, are noted for the quantity and quality of the sacks they produce. Candles are manufactured from goat's tallow, which in whiteness and quality are stated to be superior to those of wax. Their horns afford excellent handles for knives and forks; they are used in Tartary medicinally, grated down. Goats are fattened in Chili and Peru for their tallow and skins; the latter, besides their application to the purposes of holding wine, spirits, cider, etc., are generally tanned with the bark of the *palque* or the *peumo*, or the *huarango*, and sometimes with that of the *algaroba* tree, instead of the oak, and for shoes and similar articles, makes an excellent leather called cordovan, which is sold extensively all through Peru, Guayaquil, and Quito. The goats are altogether productive of great profit. The parishes about Montor, near Lyons, without pasturage or meadows, support nearly 12,000 goats, kept in stables throughout the year, and yielding a produce of more than a million francs. It is somewhat difficult to get at the statistics of the number of goats in various countries. In Russia there are about 2,500,000, chiefly in Europe; in Spain, about 5,000,000; in Austria, 2,000,000; in France, 2,000,000; in Germany, perhaps 1,000,000; in Italy, probably 500,000; in Morocco, about 12,000,000; in the Cape Colony, 2,500,000. In the United Kingdom goats are not much kept; the number in England is not much over 500,000; in Ireland, about 300,000, and Scotland and Wales may bring up the total to 1,000,000. Singular as it may appear, some years ago large flocks of goats were imported into Wales from the Highlands of Scotland. This step was rendered necessary by the almost total extinction, in many parts of the principality, of one of the original inhabitants of the country. This scarcity of the goat has arisen from the extensive inclosure of barren and waste lands for the purpose of agriculture, and the number of plantations made of late years; these, joined with the fact that the tenants have been discouraged from keeping up the breed, have materially operated in rendering scarce this hardy animal. In the Sandwich Islands a great number of goats are kept. Thirty years ago the exports of skins exceeded 35,000 per annum, and in 1855 about 104,000 were shipped. In Tasmania some few thousand goats are kept.

In the first volume of the "Bulletin of the Society of Acclimatization of Paris," p. 147, M. Barthélemy-Lapommeraye, of Marseilles, furnishes some interesting information derived from his practical experience of the various kinds of goats; American from the Antilles, Asiatic from Balbeck and Syria, African from Egypt, respecting their fecundity, habits, milking qualities, flesh and wool production. M. Sacc has also published in the Bulletin of the Paris Society a long and interesting essay on the various species of goats (Vol. III., pp. 513 and 561, and Vol. IV., pp. 3, 137, and 227). M. A. Geoffroy St. Hilaire, in Vol. IV. of the same Bulletin, p. 432, also supplies ample details as to the properties and uses of the different kinds of goats found in Algeria. A large use is made of the skins there for carrying water, which, however, always has a strong, unpleasant flavor, not to speak of the tar with which the skins are frequently impregnated. Besides their use for gloves and leather, goat-skins are sometimes made into parchment for writing on and for covering books. The extent of the trade in goat-skins may be judged of by our imports into the United Kingdom. In 1873 we imported 1,358,895 goat and kid skins undressed, valued at £174,093, and 5,456,709 more tanned, tawed or dressed, of the value of £623,087. In 1874 we received 1,436,228 undressed, and 5,506,678 dressed, etc., of the value of £847,623.

Madras is the principal source of supply, having furnished nearly 5,011,000, and the rest of India 800,000; our possessions in South Africa sent us 1,000,000, and the remainder came from Europe and Turkey. The great increase in the supply from India is evidenced by the fact that the exports from Madras in 1850 were 2,500,000, and in 1856 under 1,500,000. The Cape goat-skins are unequalled for the manufacture of superior leather; they are tanned with bark for the manufacture of black leather, and in sumach for that of colored leather called "Morocco." The shipments of goat-skins from the Cape Colony have been largely on the increase, as the following figures will show:

1868	681,259
1869	874,812
1870	893,310
1871	1,233,976
1872	1,353,703
1873	1,373,278

The local value of the skins exported in 1872 was given at £191,538, which is much more than the value of the sheep-skins exported in that year, stated at 1,424,953, valued at £139,814. It is chiefly for their milk that goats are kept, and a comparison in this respect with the relative cost of cows is much in their favor. The goat will give daily from one to four litres of milk. Those which range at large on the mountains only yield the smaller quantity, while those restrained in pastures will furnish 1½ to 2 litres, and others kept in stables will yield from 4 to 6 litres. The produce of those housed all the year in stables, nourished with about 5 lbs. of hay, will average 520 litres per annum. As a cow of medium size, weighing 650 lbs., will consume 44 lbs. of hay, and only give 1575 litres of milk yearly, it follows that by substituting five goats, there would be obtained with the same amount of forage 2600 litres of milk, or half as much again; an enormous difference. The milk of the domestic goat, although varying like that of the cow in its composition, contains generally the following proportions:

Butter	4·70
Cheese	4·85
Sugar	3·10
Salts	0·35
Water	87·00
	100·00

From this it will be seen that though it contains less fat than cow's milk, it is more rich in caseine, which renders it easier of digestion and more nutritive. One hundred litres of goat's milk yield 3 or 4 kilogrammes of butter, and 10 to 20 kilogrammes of cheese. A fat goat yields from 6 to 8 kilogrammes of tallow, which is much harder than that of other domestic animals, and is hence much esteemed by candle-makers. In the Danubian Provinces thousands of goats are killed annually for their tallow and skin. It is with kid-skins that the *glacé* gloves are made, but for this purpose the kids should be unweaned, for when they commence to eat herbs, the skin becomes encrusted with calcareous salts, which render it unfit for the purpose. From the facts which have been given, it will be seen that the goat is a more useful animal than is generally supposed. The skins of several species of Ibex, an animal of the goat kind, are used in some parts of the East. They are met with in the mountain ranges of Europe, Asia,

and Africa. The handsomest is the Jemlah Ibex of the Himalayas. The color of the *Ibex Capra* is of deep, heavy brown, the hair is harsh, and the male is furnished with a beard. The horns, which are extremely large and long, and of a deep brown color, are marked on the upper surface with protuberant, transverse knots or half circles.

Two principal varieties of goats are met with in Asia Minor. One frequents all altitudes and is found in different soils and climates, its domain being extensive; this is the black or Kurdish goat. The other is confined to a more limited area, of which the centre is the town of Angora; this is the white race, better known by the name of the town within which is its radius. Both these goats have long wool, and little difference in form, but the black goat is about one fifth higher than the white. The weight of the fleece of the black goat is from 3½ to 4 kilogrammes, the hair straight, long, and without undulations. That of the Angora goat is of a pearly white, of great purity, and falls in curled locks. The weight of good fleeces of the Angora goat will reach 2½ kilogrammes. The Cape Colony is indebted to the firm of Messrs. Mosenthal for the introduction of the Angora goat. Mr. Adolph Mosenthal proceeded in person to the East, secured some rams and ewes, and watched over them until he had successfully landed, in 1856, thirty of these goats at their destination. By the stock census of 1865 there were 121,424 Angora goats in the colony, but I have no means of ascertaining their increase in the last ten years. The following figures, however, show the progressive shipments of Angora hair from the Cape in the last few years:

1868	102,570 lbs.	1872	876,861 lbs.
1869	260,932 "	1873	765,719 "
1870	403,153 "		

There is no reason why the Cape Colony should not soon ship quite as much Angora wool as is now exported from Asia Minor. In the district of Uitenhage, as well as in others, the Angora goat is successfully replacing the common goat, and flocks of superior breed are found in Somerset. Attempts are being made to rear Angora goats in the River Plate States, and goats have been exported to that part of the world from the Cape. It is doubtful, however, whether they will thrive, as they are not accustomed to live on grassy and moist lands. Probably some of the Patagonian ranges below the Rio Negro might suit them better. The goats are used to drought and poverty, and therefore thrive on farms in the Cape Colony, which are too barren and dry for sheep-farming. Mohair, or goat's hair, is exclusively spun into yarns in Yorkshire. It is manufactured chiefly into articles of ladies' dress of great softness, lustre, and brilliancy, and there is a large increasing production from this article of what is called Utrecht velvet, for damask hangings, plushes, linings for carriages, etc. It is also extensively used both alone and in combination with silk, for making a description of goods called lustres, tabinets, and fringes. Its chief value depends on the length and fineness of the staple, its bright and silky appearance and its softness. The finer sorts of yarns are used in great quantities in Lyons, in the manufacture of lace; a good deal is also imported into Saxony, Austria and Prussia for dress goods and shawls. The imports into the United Kingdom have progressed as follows:

1841	1,000,000 lbs.	1871	8,672,631 lbs.
1851	2,000,000 "	1873	6,488,182 "
1864	4,737,330 "	1874	7,954,658 "

[Society of Arts.]

THE GRAPHIC METHOD OF TEACHING.

By B. WATERHOUSE HAWKINS, F.G.S.

MR. HAWKINS said he had in the first instance a short proposition or text to put before the meeting, from which he would endeavor to suggest the utility in the first instance, and still more the advantage, of getting into practice that useful habit of illustrating in reference to teaching the various subjects which are generally the staple difficulty of the early education of young persons, and particularly in the case of those classes which came under the influence of the London School Board. The necessity of illustrations in teaching natural history had perhaps suggested the matter to him in the first instance, but he was very strongly convinced of the truth that there was no method so impressive as the graphic of putting things before young persons. The text was this: "Through the medium of the eyesight we can receive the largest number of impressions, and retain them for the longest possible period of time, with the smallest amount of fatigue." He believed this was incontrovertible. The next statement he wished to put forward and expatiate upon was this: that art expresses ideas by the representation of natural objects selected and combined. His first text spoke for itself, though it would be easy to dilate upon it. It was a fact of nature, recognized by all, that people could sit with pleasure and see a series of illustrations put before them. He was not about to lecture on teaching drawing, but to put forward the facilities of teaching by means of the power of drawing, and making constructive diagrams. There could be no denial of these facts, and he might remind his audience that these two propositions had been on their trial now for twenty-three years, since the great Exhibition of 1851. The universal recognition of the vast value of the results of that first international display of industrial arts and manufactures from all the civilized world was a sufficient proof of this fact, because seeing and carefully examining the works of other nations had done more than could have been attained by all the essays which could have been written in the time which that Exhibition occupied.

The next great attempt to cultivate the powers of eyesight was at the Sydenham Crystal Palace in 1852, when a million sterling was subscribed and collected to carry out the largest scheme of visual education ever attempted. The educational portion of the plan originated, as was well known, with His Royal Highness the late Prince Consort. The ideas of the different departments originated with different scientific men, his own being that of extinct animals, and the association of the forms of life with the evidence of the geological periods, the different stratifications being obtained from the very ends of the earth, and combined with models which told their own story. The educational feature was the foundation of the whole plan, and it might be remembered that the charter was obtained on the declared intention that all intoxicating liquors should be excluded from the building, though that portion of the scheme had not been carried out. The main feature of the design was to show the connection between persons, things, and time, the teaching power depending upon the union and juxtaposition of some two things which related to the individual exhibited, and to the time to which it belonged. Unless this had been done it would have been a mere misleading catalogue of objects. The collection of busts was the finest ever brought together, and the description written for them by Mr. Samuel Phillips rendered them a vast school of instruction. He was sorry to say that time had worked great havoc with this collection, for on his return after many years' absence he was quite pained to see the state into which things had got; in his own department, for instance, all connection between the different strata and the animals placed upon them having been lost. It was now thirty-four years ago since he commenced in the character of a pioneer to urge upon the educational administrators the necessity for the acquirement of the power of drawing, to form part of the then feeble efforts for the education of the children of uneducated people, having in 1840 and 1841 incurred the expense of £50 for the construction of a series of geometrical models to illustrate the connection between the eye seeing and the thing seen. A Mr. Butler Williams, about the same time also, commenced holding classes in a room at Exeter-hall, for the purpose of drawing from the solid, cube and spherical forms; but it appeared to him at the time, more was done for the execution of the drawings on paper with high finish, to produce the effects of projection, than for the appreciation of the relation of the simple solids to complicated and varied forms, as to drawing the human figure or other animal forms. That instance of comparative failure led him to mark the distinction between representation or copying, and constructive reproduction of expressive forms. He was then met by the objection that drawings made from life were but copies of the model present; that a natural predilection or innate genius—an innate power born with the art student—was necessary for any degree of success, or even to enable the hand of the would-be draughtsman to make the varied curves in lines expressive of the object in view. To combat this objection, he had prepared a number of pieces of tin of various sizes, lengths, and shapes; to these small tacks were soldered, so that they might be pressed on the blackboard into the outline of any suggested form, so as to prove that the form produced was generated by the thinking faculty. Consequently, it was first necessary to lead the would-be student to direct his or her thoughts to the right construction of the form and the size of the parts. This was shown in the case of writing, the variable forms of the letters being composed of one single curve, placed in different positions, and combined with straight lines. As to the power of drawing, he would only express his conviction that the expressiveness of a drawing depended more upon the relative size of the forms, and the position of the component parts with reference to each other, rather than upon the quality or shape of the forms themselves. To illustrate this, he need only point out that in a hastily executed sketch, with a little dot for the eye, a half V-shaped line from the nose, a couple of dots, and a tick underneath for the mouth, and a few scratches to represent the hair, would, if well done, convey a most admirable idea of the individual intended. No teaching of drawing would convey that power to any individual of either sex, and here he admitted that genius was required. But as to making the forms of objects, and representing animals and other natural productions, the power of doing so might be acquired by any one with only common application, provided the right means were adopted. It was no use giving the pupil a copy to imitate, but if the generation of a line either vertical or horizontal were enforced upon them by showing them first, a blackened iron wire against a white background, or perhaps a model of a tube or a globe, and then removing it before they commenced to draw, it made a vast difference, because what they produced was the result of their own thought. They would thus obtain self-confidence, and their thinking powers would be educated, which was the great point; indeed, he maintained from long experience, that the thinking faculties had to be operated on in the first instance, and that until this was recognized in all elementary schools, there would be no practical drawing worth the time and materials expended upon it. The necessity for the hand obeying the governing thought was shown in the case of writing, though after the art was acquired it was done almost intuitively, and there was no more thinking about it. During the thirty-four years since he commenced trying to teach drawing by lecturing with constructive drawing on the blackboard, he had never heard of its being so taught, until a fortnight ago, at the Free Museum and Library in Liverpool, where a Mr. Bishop gave a most admirable lecture on constructive drawing, with illustrations by his own hand. This was very cheering, and renewed his disappointed hope that the London School Board were going to act promptly in the right direction, and have children of their schools taught drawing, not only in the ordinary manner, by making copies of lines from flat copies, but also to have some person to urge its application to obtaining knowledge of other subjects, which were to be rendered familiar to them by lectures from the travelling professor to the various district schools. The article in the *Daily News*, upon which he built these hopes, was a report of a meeting held in or about the month of September last, but sadly added that the resolution did not pass, as some members of the Board considered it too much of an accomplishment for the children of the people they had to deal with. It was, however, a sad mistake to suppose that drawing was only an accomplishment; it was one of the necessaries of life, and in his view, quite equal in importance to writing. In fact, he would rather be able to draw and represent any thing he wished than write a good hand and describe it. Even as a question of time, it took a long time to express an idea in writing, but a sketch done in a few minutes was equally expressive. With reference to this graphic method of teaching he would only say further, before giving an illustration of his meaning, that without it he did not believe it was possible to properly teach natural history or comparative anatomy; and therefore if the School Board, which now seemed to hold so important a place, were really in earnest in their educational efforts, they would certainly enforce it. But they must not begin with the children, but with the teachers. No teacher had a right to stand up in a school amongst a number of children who could not represent every object which he spoke of, and about which he professed to desire that they should know something. [Mr. W. Hawkins then proceeded, with the aid of a piece of chalk and a blackboard, to illustrate his subject by producing what he termed a "constructive diagram" of an aquatic animal, beginning with the stomach and its outlet, and then going on to add, *seriatim*, the heart, the veins, the breathing apparatus, the spinal column (which he compared to an electric telegraph cable), the ganglions, nerves, eyes, ears, olfactory organs, vertebræ, skeleton, limbs, and finally the skin, or envelope inclosing the whole.] It was precisely this kind of thing which he desired to see capable of being done by every teacher in every school for workingmen's children, because in that way they would acquire a vast deal more knowledge in a much less space of time; it would be a pleasure to them, and a great advantage to society. It was a great mistake to suppose that drawing was an accomplishment which only persons of leisure were entitled to possess. It was a means of obtaining and conveying knowledge, and he hoped it would be taken up by the School Board accordingly. He recollected a conference in that hall, just before he left England, seven years ago, when a good deal was said about compulsory education for children, at the close of which a sturdy Irishman got up and said that a great deal had been said about educating the children, but he wanted to know what was to be done for such as himself. Now this system of graphic teaching by constructive diagrams was eminently adapted for adults, as he had proved only the night before at Staleybridge, where he had an audience of more than eight hundred mill-hands and artisans, who listened and followed his teaching quite as intelligently as their more highly cultured employers. He had merely given a rough illustration, but it showed the method and system which he desired to bring forward, and which he contended ought to be universally employed.

ETCHING GLASS WITH HYDROFLUORIC ACID.

THE composition of glass to be etched is by no means an unimportant consideration, as very hard potash-lime glasses are unsuitable for the purpose. The best are the soft-lead glasses, in the manufacture of which about 10 kilos. of pure red lead have been used to 100 kilos. of sand. The crude glass articles should also possess completely uniform smooth surfaces. The transferring of designs on the glass objects to be etched is accomplished by means of the so-called "transfer-pictures."

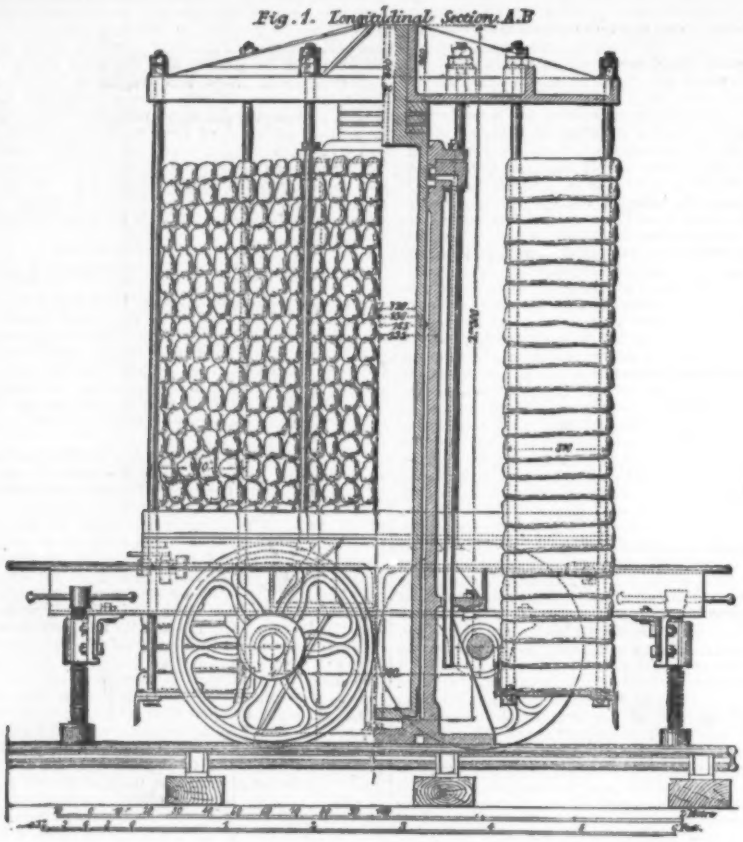
I. *Preparation of the "Transfer-Pictures."*—The paper used for this purpose should be unsized, very thin, soft, smooth, and quite free from inequalities or other faults, as otherwise it would not completely fit upon the round surface of the glass. After the sheet of paper is brought to the proper shape, it is soaked in a tolerably dilute solution of ammonium sulphate. In this process, the workman must see that his hands are perfectly free from fat or grease. The paper is carefully dried by exposure to the air. The dried paper is next brushed over pretty thickly with a substitute for egg-albumin (which is usually too dear for the purpose), consisting of warm starch-paste mixed with solution of gamboge to a deep yellow color. The paper once more dried is now ready for printing. It must be kept in a perfectly dry place. The print-color is required to satisfy several conditions. It must be somewhat adhesive, completely covered, remain unaffected by hydrofluoric acid, and must be capable of again becoming detached from the prepared paper. The print itself ought not to dry too quickly, but must adhere uniformly to the glass. The natural Syrian asphalt, which is easily soluble in pure oil of turpentine, possesses the above-named advantages. This solution is thickened with beeswax and fine resin. Pitch is also taken and purified by dissolving in alcohol, filtering, and pouring into excess of water; on again filtering, the purified resin remains as a fine whitish-yellow powder, which is dried in the cold to prevent agglomeration.

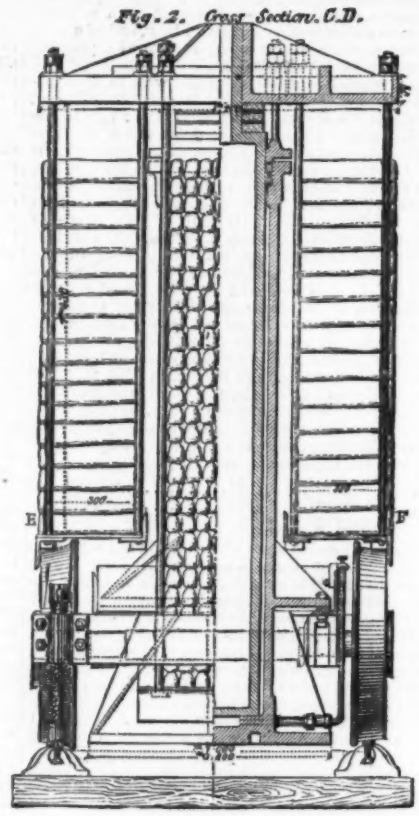
An ordinary lithographic press is used for printing the designs. The latter are deeply engraved on copper or zinc plates, so as to appear sharply defined and clear on the paper. The print-color is transferred from leaf to leaf with an elastic roller on the engraved plate, the sheet of paper being laid on and the pattern printed upon it. The prints freshly used give the best impressions on the glass objects.

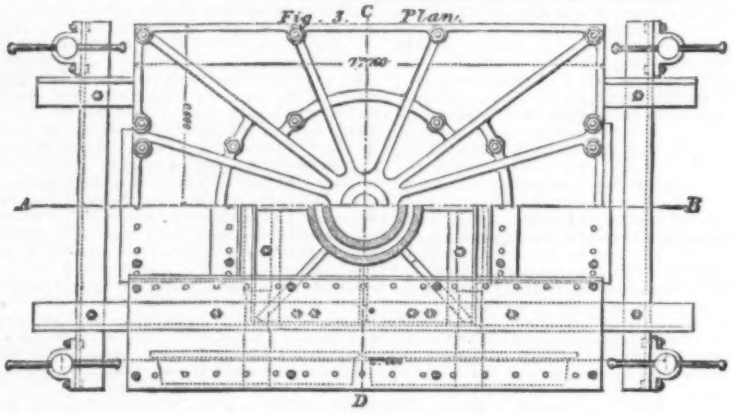
II. *The Transferring of the Patterns and Preparation for Etching.*—To illustrate the mode of procedure, an ordinary globular shade for a gas-lamp is chosen. As the patterns are always symmetrically distributed on the globe or other object in manifold number, it is necessary to make certain divisions on the surface to guide the eye. For this purpose, the globe is set upright on a revolving disc resembling a potter's wheel, and whilst being turned with the hand, the globe is equatorially marked by a feather dipped in ink; the other subdivisions are then easily made. The pattern is now printed on the right part of the globe, where it adheres securely. The paper is moistened from behind with a soft roller (similar to a roll of blotting paper) which has been dipped in water, and this is impressed on the globe, so that no wrinkles are formed. No water must get between the paper and the glass. The paper being sufficiently damp, so that the paste is softened, it is carefully raised at the edge, and slowly drawn off, leaving the brown pattern adhering to the glass. The whole globe being covered with patterns as desired, it is rinsed in cold water to remove adherent paste, and then allowed to dry. It is next dusted over with finely powdered asphalt, which adheres to the printed portions, that on the other parts of the glass being removed by a brush. The globe is now heated from 100° to 150° for five to eight minutes, by which the oil of turpentine of the color is volatilized; the other substances are fused together, and the globe is now covered with a brown crust where the form of the pattern was. On cooling, the pattern is trimmed up and improved by knife-blade and brush. Every part of the globe not so touched by the hydrofluoric acid is protected by asphalt solution, which must quickly dry. The article is then ready for the etching solution.

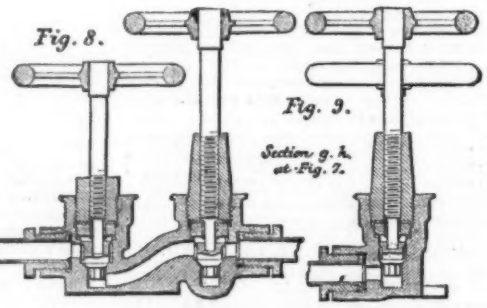
III.—*The Etching Process.*—Only dilute hydrofluoric acid solution must be used—the dilution being carried so far that fumes are no longer thrown off. The concentrated acid causes the glass to appear raw and corroded, and makes the outlines of the pattern imperfect. The process is carried out in a kind of long, narrow, wooden box, lined with sheet-lead inside (1·5 to 2 mm. thick), and furnished with a lid, fitting into a kind of lute-channel running round its outside edge. A revolving spindle or axle runs through the centre of the box, on which the globes are placed, the axle passing water-tight through bungs, securely fastened in the openings at each end, and thus forming the axis of the globe. These wooden bungs or stoppers are made quite secure with some resinous cement. Each box or vat will admit about ten globes on its axle at the same time. The duration depends on the concentration of the acid, the depth of etching required, and the hardness of the glass.

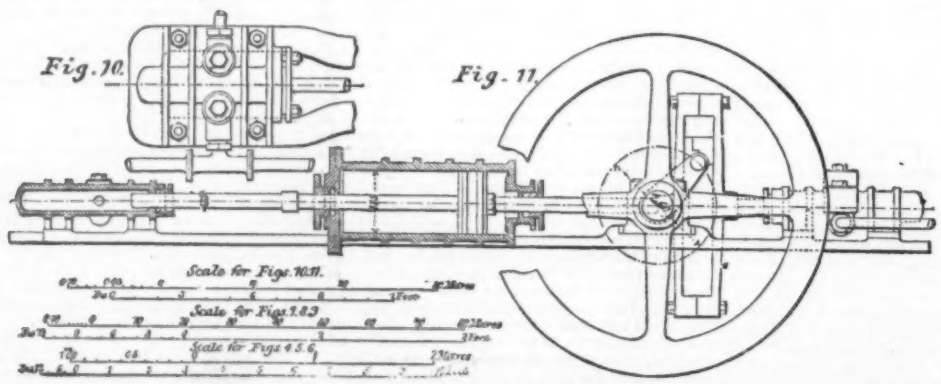
When the acid gets weak by combination with the silica and alkalis, etc., of the glass, it may be revived by the addition of sulphuric acid, which, however, must never overstep the bounds necessary for the preservation of the asphalt on the glass. The axle with the globes on it is at length removed, after revolving for a sufficient length of time, and the whole is rinsed in water, then washed in warm caustic alkaline ley to remove the asphalt protective covering, again rinsed in water, and dried. The globe is finally ground, either inside or out, as desired, with an ordinary knife-grinder's machine. For the hydrofluoric acid, the author advises that cryolite be used instead of fluor-spar, the advantage being that in the former case sulphates of sodium and aluminium are produced as residue, readily soluble in water. The lead retorts are thus easily cleansed, and a solution depositing crystals of sodium-alum is obtained, whilst in the case of fluor-spar, the resulting gypsum residue is difficult to remove, and of no value.—*Dingler's Polytechnic Journal.*











ST. GOTHARD TUNNEL ACCUMULATOR AND HYDRAULIC PUMPS.

HYDRAULIC MACHINERY AT ST. GOTHARD TUNNEL.

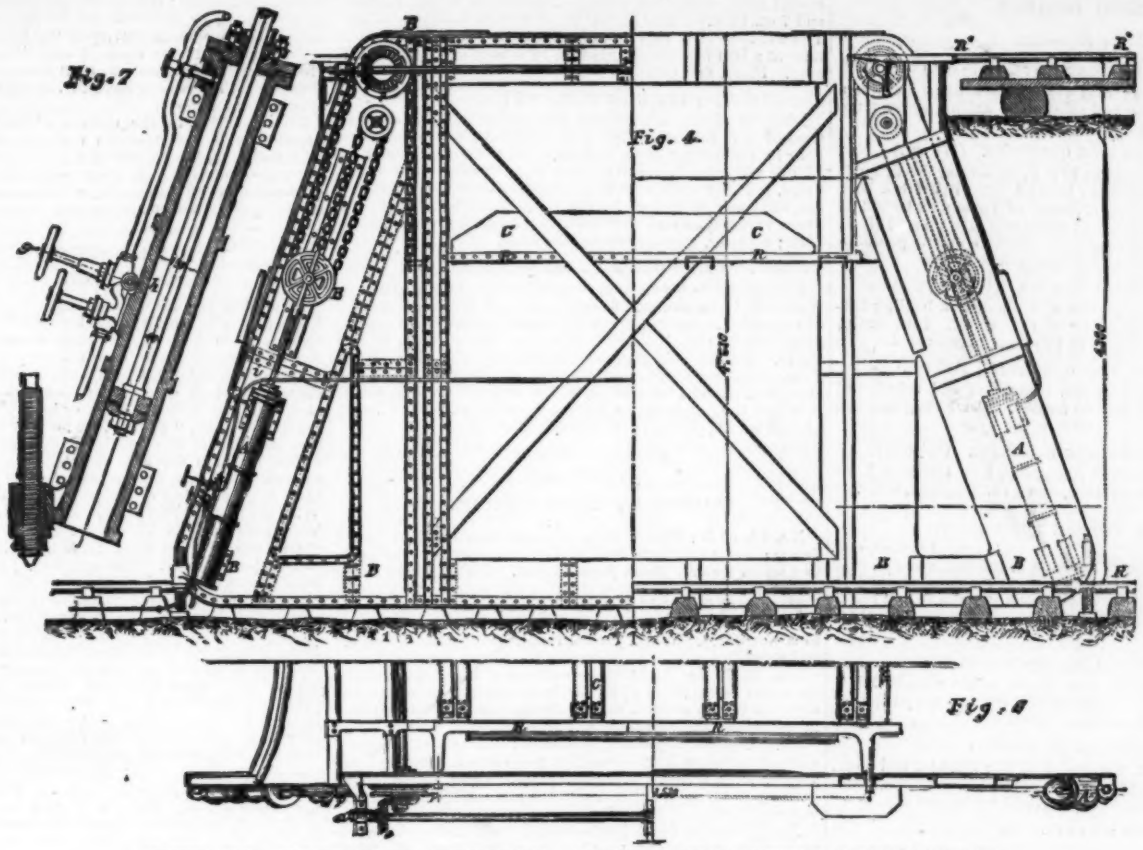
AMONGST the special plant constructed for the works at the St. Gothard Tunnel are two machines, which we illustrate on the above and adjoining page, and which are respectively a portable hydraulic accumulator, and a lift for the purpose of raising material and machines from the lower level lines outside the tunnel to those on a higher level within the workings. The lift, which is represented by the figures on the opposite page, is composed of a fixed frame B, parallel to and placed on each side of the rails, and resting upon four adjusting screws V, by which the position can be regulated. The width apart of these frames is sufficient to allow of a loaded wagon passing between them, and they are placed so as to clear the sides of the heading as shown in Fig. 6. A movable platform C is placed within the fixed frame B Upon it are two rails R, which, when the platform C is in its lowest position, coincide exactly with the rails R' laid in the heading. Movement to the platform is given by four pistons in the cylinders A attached to the frame B, the platform being connected to the pistons by means of four chains, as shown in the drawing. Shafts *a* connect, by means of bevel gearing *c*, the pulleys, *p*, and insure a uniform working of the apparatus. When the water under pressure is admitted in the upper part of the cylinder, the platform is lifted to the upper level, and the rails upon it then coincide with those laid at the higher level in the headings. The total net weight that can be raised in this manner is about 4 tons, or, including the platform, 5 tons. The maximum height to which the platform can be raised is 14 ft. 1½ in., and the working pressure on the piston is 450 lbs. per square inch. The diameter of the piston is 5½ in., and that of the piston-rods is 1.57 in. One cock controls the admission of water into each cylinder, and a second allows it to escape, when the platform is lowered. The pressure is maintained by means of the accumulator, shown by the figures on the present page, and by two pumps worked by compressed air. This apparatus is placed in a completed portion of the tunnel, so as not to interfere with the work ; it is connected by a pipe with the lift, and the air is supplied from the main air conduit in the tunnel. The air cylinder of the pump is 5.35 in. diameter, and that of the pumps, which are simple acting, is 1.38 in. with a stroke of 10.24 in. With the arrangement the platform of the lift can be raised once every 8½ minutes. The accumulators (Figs. 1, 2, 3) are interposed between the pump and the lift, in order to economize power, and the capacity of the apparatus is equivalent to raising the lift once. It consists of a vertical cylinder, in which a piston travels, and which has to be loaded to a weight equivalent to 450 lbs. per square inch. When the lift is not in operation, the piston is raised to an extent proportionate to the quantity of water introduced, which it returns to the lift when the ingress cock of the latter is opened. The diameter of the piston is 11.81 in. diameter, and the stroke is 65.03 in. The volume of water contained is 26.2 gallons, and the pressure on the piston should be 21.18 tons; the piston and crosshead weigh 1.18 tons. A load of 20 tons of lead ingots is suspended to the crosshead at the top of the piston. These can be removed at will to facilitate the moving of the apparatus from place to place on the works.

[Engineer.]

RECOLLECTIONS OF IMPROVEMENTS WHICH HAVE BEEN MADE IN THE STEAM-ENGINE DURING THE LAST HALF CENTURY.

By JOHN BOURNE, C.E.

THE locomotive competition at Rainhill in 1829, preparatory to the opening of the railway in 1830, constitutes an epoch in engineering history. Prominent among the competitors stands the name of John Ericsson, whose locomotive, the Novelty, was the most skilfully designed, and in all respects the most elegant and symmetrical of all the engines exhibited. But owing, as is understood, to an accident, she was withdrawn from the formal competition, although the high rate of speed she could attain had already been practically demonstrated. To most men the production of such an engine would have constituted an adequate claim to celebrity. In the case of Ericsson it is only a single star of the brilliant galaxy with which his shield is spangled. I feel bound to express the conviction that in all the attributes of mechanical genius—in originality of conception, joined with chastened sobriety of judgment—in penetrating analysis of the conditions to be fulfilled—and in skilful adaptation of means to the ends to be attained—no engineer who has appeared since the days of Watt and Murdoch is comparable to John Ericsson. Every department of engineering art is stamped with the records of his triumphs. In locomotive engineering nothing more original or more elegant has been produced than the Novelty. In marine engineering he introduced the screw



THE ST. GOTHARD TUNNEL.—PORTABLE HYDRAULIC LIFT.

propeller and the direct-acting engine to drive it. No doubt the late Sir F. P. Smith was engaged with the screw at the same time, and even if Ericsson had not appeared, Smith would probably have in time succeeded. But whereas Smith's progress was like that of one groping in the dark—no doubt with admirable patience and resolution—Ericsson saw the goal from the outset, and had very little to alter in his original arrangements. Then Ericsson designed and constructed the first war vessel with engines below the water-line. He is the author of the Monitor system of armor-clad war vessels, of a new system of submerged and controllable torpedoes which can be made to strike a vessel beneath the water at a distance, and of a vast number of devices which have been more or less adapted into practice.

Owing to the obtuseness of the Admiralty at the time the the screw propeller was introduced, the talents of Ericsson have been lost to this country. He has now long been settled in America. Though during many years in correspondence with him, I have never personally met him; but at my request he has prepared a brief *résumé* of his principal achievements in connection with the steam-engine, which, however, leaves out of account many minor inventions which are known to be his. This *résumé* is contained in the following letter to me:

NEW-YORK.

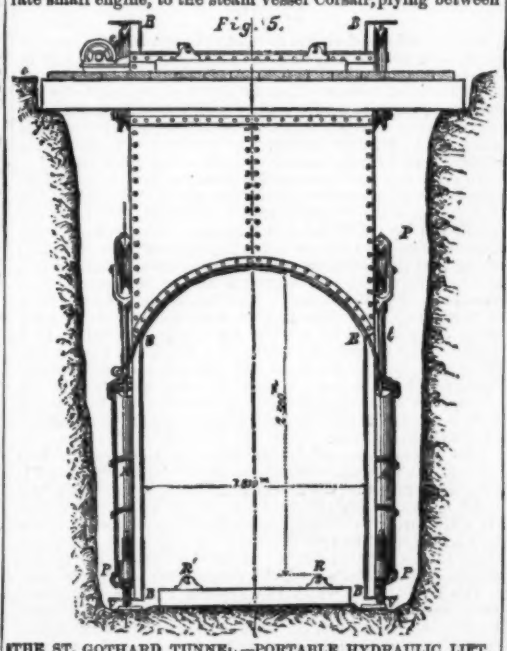
MY DEAR SIR: In accordance with your request, I now propose to give you a short account of my labors connected with the application of steam-power.

1828. Designed a steam fire-engine, mounted on a rude carriage, for experimental purposes. The working cylinder was 12 in. in diameter, placed vertically, a double-acting force pump of 8½ in. diameter being placed on each side, operated by means of a crosshead attached to the piston-rod of the steam cylinder. The machine was thoroughly tested by throwing jets of water, varying from 1 in. to 1½ in. diameter, to the top of the chimneys of certain breweries. The boiler was cylindrical and placed vertically—the furnace, slightly conical, being also vertical. The heated air and products of combustion passed off through a helical flue, terminating at the top of the boiler. The air for supporting the combustion was supplied by a reciprocating blowing machine, worked by the engine when in operation. The trials proved so satisfactory that Mr. J. Braithwaite, who built this first steam fire-engine, decided to make another, to be mounted on a light frame supported by springs, suitable to run on pavements for practical purposes. I accordingly at once designed the second steam fire-engine. The work was pushed vigorously, the machine proving a perfect success on first trial. Shortly after its completion, the memorable conflagration at the Argyle Rooms offered a chance of testing the engine in actual practice. An account of this new fire-extinguisher will be found in the *Mechanics' Magazine* of Feb. 13th, 1830. Having thus originated, elaborated, and perfected the new system, I claim to be the father of steam fire-engines, cheerfully admitting, however, that, but for the confidence and liberality of my friend and patron, John Braithwaite, it would not have been in my power to carry my plans into practice. It is proper to mention that I designed two other steam fire-engines, ordered from Braithwaite's establishment, about the same time—one for the Liverpool Docks, and one for the Prussian Government.

1829. Designed the Novelty locomotive-engine, tested on the Liverpool and Manchester Railway, during the celebrated contest with Stephenson's Rocket. The inclosed engraving represents a critically correct side elevation of the Novelty, as presented for trial to the directors of the Liverpool and Manchester Railway in the latter part of 1829. For the sake of ready reference I also inclose a drawing of the Rocket and tender.

The following extract from the *Examiner* of October 11th, 1829, shows what was thought of this engine at the time by impartial observers. Having noticed the weight, etc., etc., of the four competing engines, the *Examiner* concludes by saying: "But the speed of all the other locomotive steam-carriages was far exceeded by that of Messrs. Braithwaite & Co.'s beautiful engine from London. It was the slightest and most elegant carriage on the road, and the velocity with which it moved amazed every beholder. It shot along the line at the amazing rate of thirty miles in the hour! It seemed, indeed, to fly, presenting one of the most sublime spectacles of human ingenuity and daring the world ever beheld."

1830. Applied a centrifugal fan-blower, operated by a separate small engine, to the steam vessel Corsair, plying between



THE ST. GOTHARD TUNNEL.—PORTABLE HYDRAULIC LIFT.

Liverpool and Belfast. This device being original with me, I claim to be the father of the independent power fan-blower system for steam-vessels now universally adopted in American river navigation. So far, no one has disputed my claim.

1835. Designed a rotary propeller to be actuated by steam-power, consisting of a series of segments of a screw, attached to a thin broad hoop supported by arms so twisted as also to form part of a screw. The propeller subsequently applied to the steamship Princeton was identical with my said design of 1835. Even the mode adopted to determine, by geometrical construction, the twist of the blades and arms of the Princeton's and other propellers, was identical with my design of the year last mentioned.

1836. Constructed a small propeller boat, operated by steam-power, in a large circular cistern, for the satisfaction of certain parties intending to take an interest in my invention, and to furnish means for securing letters-patent for the same.

1837. Constructed a steam-engine for imparting motion directly to the screw propeller shaft, consisting of two steam cylinders placed diagonally at right angles to each other, the connecting-rods of which were coupled to a common crank-pin. This engine was applied, in the year 1838, to the iron screw-steamer Robert F. Stockton, which crossed the Atlantic, under canvas, 1839, and was afterwards employed as a tugboat on the river Delaware for upwards of a quarter of a century.

1840. Designed a steam fire-engine—see accompanying engraving—for which I received the great gold medal of the Mechanics' Institute of New-York. It may be well to add that this corporation had offered as a prize its great gold medal for the best design of a steam fire-engine.

1842. Constructed a semi-cylindrical, direct-acting steam-engine, and applied the same to the United States propeller steamship Princeton. This engine was placed entirely below the water-line.

1842. Constructed a telescopic chimney for the same steamship, which, by means of a chain and endless screw, could be lowered when desirable, so that its top was brought as low as the ship's bulwark. It will be proper to observe that the combustion in the boiler-furnaces, while the chimney remained thus lowered, was supported by air supplied by centrifugal fan-blowers operated by a separate engine, as in the British steam-vessel Corsair, in the year 1830, before referred to.

1861. Constructed steam-engines for training heavy naval ordnance applied within cylindrical turrets, the training being effected by causing the turrets to revolve by the intervention of gear work actuated by the said steam-engines. Constructed a steam-engine for the purpose of destroying ships by a submerged torpedo propelled under water by atmospheric air compressed by the said steam-engine, and transmitted through a tubular cable. The power developed by steam thus indirectly caused the destruction of the distant ship. I beg that you will seriously reflect on this matter. Probably the stated mode of destroying a ship at a distance is one of the most remarkable applications of steam-power yet devised, proving the inexhaustible adaptability of that extraordinary agent.

I am, my dear Sir,
Yours very truly,
J. ERICSSON.

JOHN BOURNE, Esq., C.E., London.

THE MARBLE QUARRIES OF PAROS.

IN some notes of a tour in the Cyclades and Crete a contributor to the *Academy* gives the following account of the marble quarries of Paros:

"At the mouth of that which is considered the finest there is a curious sculptured tablet on the rock, containing numerous group of figures, conspicuous among which is a seated female deity, with a dedication to the nymphs below. This is figured in one of the plates to Stuart's 'Antiquities of Athens,' but now a large piece has been broken off the face of it. With deep indignation it was ascertained that last year an Englishman (who shall be nameless) cut this piece off and carried it to England; subsequently, on a letter of remonstrance being addressed to him, he returned it, and it is now at the monastery in the packing-case in which it was sent. When the point was reached where daylight ceases, tapers were lighted, and the dogs that accompanied the party first whined dismally, and finally returned to the upper air. The visitors had expected to find the quarry worked in regular shafts, but, instead of this, the dip of the strata has been followed, and consequently the passage descends at a considerable incline, winding about in different directions, and the roof slopes from left to right. It varies in height from 16 ft. to less than 3 ft., so that sometimes it is necessary to crawl on hands and knees; in these places the passage must have been wider formerly, to allow of the stone being carried out. At one point 200 bats were hanging from the roof, but fortunately they were not disturbed by the lights. The marks of the tools of the old workmen were visible everywhere on the roof and sides, the groovings being about 2 in. apart; the amount excavated must have been immense, for the whole place has the appearance of a labyrinth, and the guides declared a stranger might wander for a day without finding the end. The marble on the surface is not usually white, but where it is broken it is brilliantly pure; in some parts the grain is very fine. After being fifty minutes under ground the visitors returned to daylight, and proceeded to a second quarry, where, however, the marble is somewhat inferior. In places there were stalactites in process of formation, but none were to be compared with those of Antiparos. It is deeply interesting to think that from these quarries came the material for most of the famous Greek statues that have come down to us, and for several important temples, such as that of Apollo at Delphi, which was rebuilt of this stone by the Alcmeonidæ."

DYEING RECIPES.

From Reimann.

PANSY FOR SILK GARMENTS. (17½ ozs.)

DYE at 167° F., having first washed the articles well, in a beck of 4½ ozs. curd soap and solution of aniline violet more or less according to shade.

LIGHT BROWN ON SILK GARMENTS. (17½ ozs.)

Wash for fifteen minutes at 167° F. in a clear beck, made up with 1¼ oz. genuine cutch; lift and enter in a fresh beck at the same heat, with ¾ oz. chromate of potash, and work in this for a quarter of an hour; rinse and dye up at 167° F. with a little vesuvin and magenta. Vesuvin should predominate for yellowish tones, and magenta in red ones.

BLUE ON SILK GARMENTS. (17½ ozs.)

Wash and work for a quarter of an hour in a boiling kettle of ¼ oz. Nicholson blue, and 3¼ ozs. borax. Lift, drain, and take through a cold beck of 3½ ozs. sulphuric acid.

SILVER GREY ON SILK GARMENTS. (17½ ozs.)

Make up a beck with 3½ ozs. alum, and add solution of indulin and magenta as may be needed. Enter the goods and dye at a boil.

CORINTH BROWN ON SILK GARMENTS. (17½ ozs.)

Make up the kettle with 3½ ozs. orchil, 1 oz. turmeric, 1 oz. sulphuric acid, ¾ oz. violet lake, and ¼ oz. magenta, and dye at a boil.

BROWN ON WOOLLEN PIECE-GOODS.

Boil for one hour with 2 lbs. 3 ozs. chromate of potash, and the same weight of argol. Let cool in the flot, and dye at a boil for one hour, with 44 lbs. fustic, 11 lbs. madder, and 11 lbs. camwood. Take out, and dissolve in the beck 2 lbs. 3 ozs. copperas, and 17½ ozs. blue vitriol. Re-enter, and boil for an hour longer.

DRESSING FOR WHITE SHIRTINGS.

For 175 pints of dressing take 11 lbs. wheat starch, 2 lbs. 3 ozs. stearine, and 6 lbs. 9 ozs. china clay. Boil up together and apply hot, and dry on the cylinder.

PANSY ON JUTE. (11 lbs.)

Wet out perfectly in water at 100° F.; lift, and add ½ oz., or a little more according to shade, of soluble violet, previously dissolved and filtered. Enter, give 5 turns, and dry.

CRIMSON ON JUTE. (11 lbs.)

Wet out as before, and dye with ¼ oz. to ½ oz. of magenta.

BISMARCK ON JUTE. 11 lbs.)

Wet out and dye with ½ oz. to 1 oz. vesuvin.

MODE ON JUTE. (11 lbs.)

Boil out 17½ ozs. of prepared catechu. Pour the solution into water at 100° F., and dissolve therein 1¾ oz. blue vitriol. Wet out the jute in water at 100° F., enter in the catechu beck, and work for half an hour. Take out, and add the solution of 1¾ oz. chromate of potash. Re-enter, work to shade, rinse and dry.

GREY ON JUTE. (11 lbs.)

Boil 17½ ozs. sumach in water, and steep the jute for an hour in the liquid. Take out, and dissolve 17½ ozs. of copperas. Enter the goods and dye to shade. If a blue-grey is required make up a fresh beck at 77° with the solution of 17½ ozs. alum and ½ oz. extract of indigo. And a very little solution of magenta, enter the goods and dye to shade.

FAST GREEN ON WOOL. (219 lbs.)

Prepare at a boil for ninety minutes with 19½ lbs. sulphate of alumina (cake alum); 4 lbs. 14 ozs. chromate of potash, the same weight of sulphuric acid, and 1 lb. 10 ozs. tin crystals. Then boil up in the dye-pan 1 lb. 1½ oz. sulphate of alumina, and remove scum if needful; add 46 lbs. "chemic" (some extract of indigo), 18 ozs. French extract of fustic, and 17½ ozs. salt. Boil for 1½ to 2 hours. The chemic is prepared with 6 lbs. 9 ozs. indigo, and 26 lbs. 4 ozs. fuming sulphuric acid, diluting with 44 lbs. water, after standing for twenty-four hours.

GOLDEN OLIVE ON WOOL. (219 lbs.)

Boil for ninety minutes with 6 lbs. 9 ozs. chromate of potash, 3 lbs. 4½ ozs. blue vitriol, and 1 lb. 10 ozs. sulphuric acid. Then dye with 13 lbs. French extract of fustic, 17½ ozs. French extract of logwood, 6 lbs. 9 ozs. sanders, and the same weight of madder. Boil for seventy-five minutes, sadden with 1 lb. 10 ozs. copperas, and boil thirty minutes longer.

PANSY ON SHODDY. (109 lbs.)

Prepare with 2 lbs. 3 ozs. chrome alum, 2 lbs. 3 ozs. sulphuric acid, and ¾ oz chloride of tin. Then dye to shade with aniline violet (soluble in alcohol).

GREEN FOR HALF-WOOLLEN GARMENTS. (11 lbs.)

Make up a beck with 17½ ozs. alum, 8¾ ozs. argol, 17½ ozs. fustic, and 3½ ozs. extract of indigo. Boil the goods in this for an hour, rinse; prepare with 3½ lbs. sumach, wring out and top in a fresh cold beck with 1¾ oz. methyl-green.

GREY FOR HALF-WOOLLEN GARMENTS. (11 lbs.)

Prepare for three hours with 3 lbs. 12 ozs. sumach, wring out and boil for three quarters of an hour with 4½ ozs. logwood, and 1 oz. fustic. Sadden in the same beck with 1¾ ozs. copperas at 200° F.

BRONZE ON CLOTH AND WOOLLEN PIECE-GOODS. (45 lbs.)

Boil for ninety minutes with 5½ lbs. alum, 2 lbs. 12 ozs. argol, and then same weight of blue vitriol. Take out and dye at a boil for one hour in a fresh beck with 32 lbs. 13 ozs. fustic, 2 lbs. 12 ozs. logwood, and 13 lbs. 11 ozs. madder. Take out and sadden to shade with 3 lbs. 4 ozs. to 5 lbs. copperas.

PONCEAU ON COTTON YARN. (11 lbs.)

Boil for one hour with 8¾ ozs. curd soap, take out and enter in a boiling beck of 1 lb. 10 ozs. annatto, and 10½ ozs. soda crystals. Here let it remain for six hours. Take out and enter in a beck of bichloride of tin at 3° Baumé, where it is left for three hours with frequent turning. It is then taken through water and dyed at 167° F., with the clear solution of 6½ ozs. saffranin.

GARANCINE RED ON COTTON. (11 lbs.)

Prepare right at a boil with 2 lbs. 3 ozs. sumach. Dry and enter in a beck of red liquor at 7° B., where it is left for six hours, with frequent turning. Take out, and soak well in a fresh hot beck of 17½ ozs. elutriated chalk and 2 lbs. 3 ozs. cow-dung. Rinse and dye in two becks. The first consists of 14 ozs. garancine, 5½ ozs. sumach, and 7 ozs. bran. Enter at 77° F., and raise the heat slowly to 167° F. Enter in the second beck, consisting of 27½ ozs. garancine, 14 ozs. sumach, and 7 oz. bran. Enter at 144° F., and raise slowly to a boil. The whole time in this second beck is an hour. Rinse, and raise at a boil for fifteen minutes, in a beck of 17½ ozs. curd soap. Rinse, and dry.

BLACK ON JUTE. (54 lbs.)

Dissolve 5½ lbs. solid extract of logwood and 17½ ozs. extract of bark in water. Steep the jute for a quarter of an hour in the boiling beck, and enter in a fresh cold beck of 13 ozs. red chromate and 8½ ozs. blue vitriol. Give seven turns, take out and return to the logwood beck, in which 21½ ozs. soda ash have been in the mean time dissolved. Give seven turns, take out, and dissolve 17 ozs. copperas in the beck; re-enter, give five turns, and rinse.

DYEING AND FINISHING BLUE COTTON SATINS. (100 yards.)

Run the goods for an hour through a hot cistern made up with 1 lb. 1¾ oz. sumach, 6½ ozs. soap, and the same weight of rape-oil. Make up a fresh boiling beck with 5½ lbs ground alum and 6½ ozs. Nicholson blue, and run through this to shade. For the finishing, take, to make up 175 pints, 5 lbs. 7 ozs. gum tragacanth, and dissolve it in water, adding the clear solution of 1 oz. Nicholson blue and 5 lbs. 7 ozs. alum. Stir into the hot mixture 17½ ozs. stearine and 5 lbs. 7 ozs. glycerine. Apply hot, dry, and calender.

[Chemical Review.]

PRACTICAL DYEING RECIPES.

No. 13. 60 *lbs. Fine Yellow.*—Bleach, then mordant in red liquor; boil 3 lbs. picric acid in 3 gallons of water; add this to a warm water. Work yarn 5 turns. Wash in cold water and stove.

No. 14. 60 *lbs. Light Yellow.*—Bleach; boil 3 lbs. turmeric in 3 gallons of water, with three lbs. of alum; add this to a hot water. Work yarn 5 turns. Wash in cold water and stove.

No. 15. 60 *lbs. Light Straw.*—Bleach; mordant in either tin or red liquor; boil 1¾ lb. fustic extract in 3 gallons of water; add this to a warm water. Work yarn 5 turns. Wash in cold water and stove.

No. 16. 60 *lbs. Light Buff.*—Bleach; add to a cold water 6 gills of nitrate of iron. Work yarn 5 turns and wring; add a clear lime water. Work yarn 5 turns and wring; work yarn again through old iron liquor 5 turns. Wash off in cold water and stove.

No. 17. 60 *lbs. Light Buff.*—Bleach; add a clear lime water; work yarn 5 turns and wring; boil 2 ozs. Bismarck brown (Brooke, Simpson & Co.); add this to a cold water. Work yarns 5 turns. Wash in cold water and stove.

No. 18. 60 *lbs. Dark Buff.*—Boil 6 lbs. turmeric with 3 lbs. of alum in 6 gallons of water; add this to a hot water. Work yarns 5 turns and lift; add 6 gills nitrate of iron; 3 turns more. Wash in cold water and stove.

TONE OF ELASTIC BARS SATURATED WITH LIQUIDS.

THE vibrations of elastic rods have been variously investigated, both theoretically and experimentally. But the way in which these vibrations are altered when the chief qualities of the elastic rods are modified in any way, especially by the rods being made to absorb some liquid chemically indifferent, has not before been studied. The subject has lately been taken up by M. Carl Müller, who describes experiments regarding it in a recent number of *Poggendorff's Annalen*.

To carry out the investigation under as simple conditions as possible, substances were selected which are not altered in their dimensions by the penetration of liquids into them and which can be easily brought into any required shape. The most suitable were soon found to be bars cast from gypsum; owing to their crystalline structure they have great hardness, and give very clear and beautiful tones. Seven such bars were prepared, five of them cylindrical, and two in the form of parallelopipeds. The former were obtained by pouring paste of gypsum into a wide glass tube—the latter in a quadrangular trough—the bars being taken out after solidifying of the paste. These bars were thrown into transversal vibrations in this way: a fine glass rod held fast in the middle, but with its ends free, was set vibrating by rubbing with moistened fingers, and the vibrations were communicated to the gypsum bar.

The measurement of the vibrations of the gypsum bars presented the greatest difficulties. M. Müller accomplished it by transferring the vibrations to a freely-hanging slightly tense thread, which produced a system of continuous waves. On a measuring rod brought behind the thread the size of the half waves could be read off, and thus the number of vibrations of the gypsum bar could be calculated. For further details of M. Müller's method we must refer to the memoir.

The liquids with which the gypsum bars were saturated were, successively, water, alcohol, and ordinary rape-seed oil. In the case of each rod, the pitch of tone was first determined in the dry state, then the observation was made with water; the water was then evaporated, and the gypsum, again dry, saturated with alcohol; after experimenting with this, the alcohol was volatilized, and the bar saturated with oil. For absorption of the liquids the bars were placed in a trough of sheet-zinc containing the liquid, and they were left in it generally about a quarter of an hour.

Trial of the first dry, then water-saturated bar, showed, in the first place, that by entrance of the liquid a *considerable lowering* of the number of vibrations is effected. A comparison of this change of pitch with the simultaneous change of weight through absorption of liquid further showed that the imbibed liquid does not act as a weighting of the vibrating bar, but that rather, in union with the molecules of the rigid body, it forms in some sort *a new elastic bar*, which exactly follows the theory of rigid systems; only through entrance of the liquid, there arises a change in the molecular nature of the bars, revealing itself in a fall of pitch.

From the values obtained from all seven bars with the three different liquids, it further appeared that the lowering of pitch by imbibition of liquid was greatest with water, less with oil, and least with alcohol.

In discussion of the values obtained, M. Müller makes the following additional statements, and illustrates them: In the lowering of the number of vibrations by water, there is at first, in the individual bars, no regularity; still, notwithstanding the different structure of the bars, the decrease does not go beyond certain limits. More regular is the change of tone through alcohol and oil. An almost perfect regularity, however, is observed if the changes of tone of the saturated bars are compared with one another, and not with the dry state.

The change of tone is dependent on the specific gravity of the imbibed liquid; *it is greater the higher the specific gravity of the liquid*, or the vibration number of such a bar is inversely as the specific gravity of the liquid.

The change of tone through absorption of liquids is also produced by *a change—namely, a decrease of the coefficient of elasticity*. This occurs most in the case of water, less with alcohol, least with oil.

No regularity in the change of pitch of the saturated gypsum bars, in comparison with the dry bars, is here recognizable. A comparison of the condition of each bar, when it has taken up liquid, shows a change of the modulus of elasticity to a certain degree, which is only different for different liquids set over against each other.

[British Medical Journal.]

"DRUNK OR DYING."

IN several articles we have insisted on the difficulty there frequently is in the diagnosis between intoxication and fatal apoplexy. In particular we have stated that apoplexy from cerebral hemorrhage imitates not only the comatose stage of drunkenness, but occasionally what we call the "uproarious" stage. A recent case exemplifies this remark. A gentleman was found lying in a gutter by a policeman, and, as the gentleman sang, "Tommy, make way for your uncle," and also said part of the Lord's Prayer, he was supposed to be drunk, and was taken to the police office. Later on, as he seemed to be in a fit, he was sent to a hospital, and died there next morning of apoplexy from disease of the brain. Whether that apoplexy was owing to cerebral or meningeal hemorrhage or not we do not know. The difficulty is, of course, the greatest when there is no history, as in hospital and in police cases. The apoplectic patient, from the text-book's point of view, is taken ill at home, and under circumstances in which the diagnosis, so far as to exclude drunkenness, is ready made. In hospital and police practice, the history is too often like that of this poor gentleman: he is found in a gutter insensible or uproarious. But not only may a patient be violent in cases of apoplexy to be speedily fatal, but he may, when otherwise apparently deeply insensible, perform elaborate actions. We must be on our guard, not to be misled by these cases. Let us mention one or two cases of automatic actions occurring during coma. We have never seen actions so striking as that of singing a comic song in a case of apoplexy. The "suggestion" of the particular action often seems to be given by what the patient was doing when his illness set in. Thus, a woman who had fractured her skull by falling down stairs while she was laying down some oil-cloth, kept arranging the counterpane when partly insensible; she died in a few hours. We have seen a lady who during otherwise deep coma would elaborately sponge her face when the sponge was put into her right hand, and this only a few hours before her death. By the way, this lady's symptoms at the onset were to the popular mind so like those of drunkenness, that she was hailed by the street boys, "See the drunken lady," when she was brought out of the house where she was first taken ill. Sometimes the automatic action is the survival of a deeply organized habit. Dr. Hughlings Jackson has recorded the case of a man who during fatal coma elaborately twirled his moustache. It was afterwards found that this was a very common trick of his. He had been a soldier. We consider it a great misfortune that such cases are often looked on as mere scientific curiosities, and, again, that a comparative study is is not made of the effects of alcohol, epilepsy, and other comatising agents. We insist that the performance of very elaborate actions may be seen in cases of apoplexy to be speedily fatal; they occur too after epileptic seizures and after drinking. Hence, difficulties in diagnosis. These cases are illustrative of Laycock's doctrine of the reflex function of the brain. A careful study of automatic actions occurring in numerous cases of insensibility from various causes, by the light of several principles enunciated long ago by Laycock, would be very profitable, not only as the means of investigating important problems in that which is commonly called the "physiology of mind," but for the directly utilitarian purposes of diagnosis and prognosis.

LOW TEMPERATURES BY CARRE'S FREEZING APPARATUS.

IF, during the cooling of the apparatus, a mixture of ice and common salt be added to the water which surrounds the iron cylinder, the temperature is lowered sufficiently to freeze several kilograms of mercury, and to stand afterwards as low even as —48°. The use of ice and salt in connection with the condenser during the first operation of heating does not appear to be any material advantage.

BOILING OF SULPHURIC ACID.

A. BOBIERRE indicates that sulphuric acid may be most easily boiled, with quiet and regular ebullition, by heating it over a rose-burner in a retort containing a sufficient quantity (about 5 per cent) of thin strips of platinum foil. The indications of a thermometer in the vessel are remarkably constant, which is not the case in irregular ebullition.

TELEGRAPHING BY THE AURORAL CURRENT.

MR. G. N. HENSON, telegraphic operator at Loudon, Tenn., writes to the *Telegrapher* that on the evening of January 14th, 1876, his attention was attracted to a peculiar noise in the cores of his relay magnet, similar to that heard during a thunder-storm, caused by the presence of atmospheric electricity. It gradually increased until the relay worked as if some one was opening and closing the circuit. At first he attributed the breaking to some one working with an instrument on the line, but was at a loss to account for the constantly disturbed condition of the current. That some atmospheric electrical phenomenon was going on he soon became satisfied, and while taxing his imagination as to what that phenomenon was, the idea of an aurora borealis suggested itself to his mind. He at once disconnected the battery from the line, and to his astonishment the relay responded to the opening and closing of the key, as if the battery had never been disconnected. He worked the line for nearly two hours without any apparent difficulty, without a single battery being in circuit; but after the first two hours it became too weak to work the relay without considerable trouble in adjusting. As it grew weaker it permannetly settled its polarity in opposition to the direction in which his battery formerly connected, which obliged him to change the poles of his battery with reference to the time, so as to harmonize with the auroral current, which was strong enough to almost neutralize the battery current when connected in opposition to it. At ten o'clock P.M. it had undergone no change, but this morning every trace of it had disappeared.

[Insurance Chronicle.]

THE FIRES OF 1875.

WE have managed to burn up during the year that is past property to the value of $86,328,035, of which loss $43,631,700 was distributed by means of insurance, and the remainder—a nearly equal amount—fell exclusively upon the owners. The tax we have paid to the "fire fiend" amounts on the average to about $10 per annum for each productive life in the country. And of this tax 75 per cent, at a moderate computation, was inflicted by causes entirely preventable—chiefly by carelessness and incendiarism.

Of the total loss, $55,373,900 was caused by the burning of 3662 "specials," and on account of this the insurance companies paid $38,052,890. October bravely maintained its reputation as the most disastrous month of the year, the losses during that month being $12,953,095. Strangely enough, the months of March and September, notorious as months of turbulent winds, show the least loss—$4,095,400 and $4,876,750 respectively.

But the chief feature of our compilation, and that which gives it a value not easily to be calculated, is the report by months of special hazards burned in this country and Canada. The agent and the solicitor who wishes to convince the owner of any special hazard that his property is liable to burn, and the established rate is not extortionate, has only to produce this table.

First in the number come hotels, of which no less than 337—nearly one per day—were burned during the year. And these burnings were distributed pretty evenly throughout the year. Hotels burn in all seasons—in season and out of season—and in all latitudes and longitudes.

Next on the list come sawmills, of which 261 burned—the greater "mortality" being in the summer months, when many of them are idle. Liquor stores make a brave effort to keep up with hotels and sawmills in inflammability, but only 168 of them succeeded in getting burned. Drug stores—which every druggist will tell you never burn—come in a good fourth, with 133 burnings. Restaurants are close after them, with 126; and 119 livery stables were converted into chariots of fire.

Then come 107 losses on furniture factories, 96 on machine shops, 78 on flouring mills, 83 on planing mills, 78 on carpenter shops, and 73 on blacksmith shops.

Churches and lumber yards and public halls burn very evenly; 75 churches, 74 lumber yards, and 72 public halls.

Tanneries and woollen mills, newspaper offices and printing offices, keep close together in the race for destruction; 51 of each of the first three burning and 48 printing offices.

Cotton mills, cooper shops and carriage factories make about the same contributions to the total number of losses, and woodworking establishments of every kind do their utmost to swell the aggregate.

But this table must not be mistaken for a guide by which the relative inflammability of different hazards can be computed. Because it records the burning of thirty-six breweries and but one celluloid factory, it would be absurd to infer that breweries were thirty-six times as hazardous as celluloid works. There were about 3600 breweries in the country. There was but one manufactory of celluloid, and that burned.

VENTILATION OF CLEVELAND IRON MINES.

THE provision, now being made, of enlarged ventilating apparatus at several of the chief iron mines in Cleveland draws attention to the modes adopted in these. The ordinary furnace, the fan, such as Guibal's, and the ventilating machine, are the three modes in use; and it is becoming yearly more apparent that the first is losing ground, and fans and machines—especially the latter—are taking its place. Still, in some of the largest mines in Cleveland, ventilation is wholly effected by the furnaces, some of which are of large dimensions. At Huntcliffe mines, a column of air, equal to 22,813 ft. per minute, passes over one of the furnaces; at Brotton, nearly three times the volume of air passes in the same time over the furnace; whilst at one time the Upleatham mines were ventilated by five furnaces, supplying 170,130 cubic feet per minute, but machinery has been introduced to dispense with these. Several fans are in use—one of the largest, on Guibal's principle, being employed at Eston mines, the dimensions of which are 37 ft. diameter and 12 ft. breadth, and which, when driven at the rate of fifty-two revolutions per minute, displaces 164,000 cubic feet of air in that time. The machines in use were first tried at the Lofthouse mines, where one of Cooke's was erected in 1872, composed of two sheet-iron drums, about 8 ft. in diameter and 16 ft. in length, mounted eccentrically on shafts. For this invention claims have been set up that it more fully ventilates the mine with an expenditure of less than one-half the fuel. The first of these machines having demonstrated its superiority to the old furnaces, it has been replaced by one on the same principle, but on a much larger scale, and a second is now being laid down at Lofthouse mines; and the principle has also been adopted at other mines of the Messrs. Pease. It is becoming increasingly evident in Cleveland that larger outputs will be demanded from the mines after the present depression is past, and with an increasing output increased ventilation is necessary, so that more and more ventilation will be attempted by machines and fans, to the growing disuse of the old-fashioned furnace.

[Monmouth Democrat.]

THE CEDAR MINES OF NEW-JERSEY.

AMONG the strange productions of Cape May, are the "cedar mines"—swamps of dark miry stuff in which are buried immense trees of the white cedar, *Cypressus thyoides* of the botanists. These mines contain enormous trees, buried to a depth varying from three to ten feet. The logs lie one across another, and there is abundant evidence that they are the growth of different successive forests. Indeed, in these very swamps forests of the same trees are now growing. The miners become very skilful at their work. An iron rod is thrust into the soft mud, over which often the water lies. In striking a buried tree, the workman will, by several soundings, at last tell how it lies, which is its root end, and how thick it is. He then manages to get a chip of the tree, and by its smell determines at once whether it is worth the labor of mining—that is, the workman will tell unerringly whether the tree be a *windfall* or a *breakdown*. If a breakdown, it was so because it was decayed when standing; if a windfall, the tree fell while sound, and has been preserved ever since by the antiseptic nature of the peat marsh in which it was buried. The soft earth is then removed. This makes a pit in the swamp. Into this the water soon flows and fills it up. This is rather an advantage. The saw is now introduced, and at regular intervals a cut is made through the tree, when the log floats to the surface. It is curious that the log of a sound tree will be sure to turn over when it floats up, the lower side thus becoming uppermost. Trees in this way are sometimes obtained which will yield 10,000 shingles, worth $20 per thousand; thus one tree will yield $200. The age of such a tree, as the season rings have been counted, has been made out from ten to twelve hundred years, and even more. A layer of such trees is found covered by another layer, and these again by another, and even a third, while living trees may still be growing over all. It is evident, indeed, that New-Jersey has experienced what the geologists call "oscillations." Cape May contains abundant evidence of having been lifted out of a modern sea. The recent oyster and clam are found in natural beds, just as they died in the ocean, but now in positions many feet higher than the contiguous oyster-beds; while buried trees exist at depths lower than the beds of living mollusks.

[The Whalemen's Shipping List.]

STATISTICS OF WHALING.

THE present whaling-fleet is 169 vessels, against 163 January 1, 1875, 171 in 1874, and 203 in 1873, and the number at sea January 1, 1876, was 137 vessels, against 119 a year ago, and 123 in 1874. Any further increase in the fleet must necessarily result in lower prices for oil.

Right whaling makes a good exhibit for the year, vessels in the Arctic Ocean having been very successful, 13 vessels taking 18,000 barrels whale and walrus oil and 180,000 pounds whalebone, an average of 1384 barrels oil and 13,818 pounds of whalebone. Three vessels on Kodiak and Bristol Bay took 3980 barrels whale oil and 45,436 pounds whalebone; thus making for the fleet an average of 1374 barrels whale and walrus oil and 14,091 pounds of whalebone, the largest average of any season since the year 1850.

As we stated in our review last year, we do not believe Arctic whaling will be given up, and certainly the whales have never been plentier on these grounds than during the past season. The fleet have all come out safely except the barque Desmond, which is supposed to have been obliged to winter there.

A few vessels in Hudson's Bay and Cumberland Inlet have had fair success, while right whaling in the Southern Oceans has been neglected. Humpbacking has been very successful on the coast of South Africa, while in other localities the catches have been moderate.

Sperm whaling has been only moderately successful, there having been but few large catches during the past year. Vessels have done best on Chili and the Off Shore ground, while elsewhere the average has been moderate. A summary is as follows: On Chili and Off Shore 17 vessels cruised, taking 7010 barrels sperm, an average of 412 barrels; on New-Zealand, 17 vessels took 6095 barrels, making an average to each of 358 barrels; in the Indian Ocean and on New-Holland there were 13 vessels, taking 4335 barrels, an average of 333 barrels; and in the North and South Atlantic oceans, 87 vessels, with a catch of 19,405 barrels, averaging 223 barrels; the last named being for an average of about ten months, as many of the fleet winter in port. With any increase of the fleet, a smaller average may be looked for, and it will be already seen by reference to our columns, that the number of vessels at sea which have obtained 1000 barrels or more of sperm oil is smaller than for many years.

The distribution of the whaling fleet for the present year we estimate as follows: North and South Atlantic, 77 vessels; Indian Ocean and New-Holland, 15 vessels; New-Zealand, 13 vessels; Pacific coast and Off Shore ground, 23 vessels; North Pacific, 18; Cumberland Inlet, 4 vessels.

The number of vessels estimated to arrive at this port (New-Bedford) the coming year is 25, of which apparently 13 will be good voyages, while 12 will show a loss, the net results being much the same as for the past few years.

Stocks of oil and whalebone in the United States January 1, 1876:

	Bbls. Sp.	Bbls. Wh.	Lbs. Bone.
New-Bedford.....	7062	8110	168,800

MANUFACTURE OF COKE.

AN improved form of coke oven, which is claimed to produce about 25 per cent more coke, and to effect more than 50 per cent saving in the cost of labor, has recently been introduced by Messrs. McLanahan, Stone, and Bayley, of Hollidaysburg, Pennsylvania, and has given great satisfaction. The ovens are 36 in. wide, 7 ft. high, and 22 ft. long, and present the appearance of a succession of arcades, closed at each end with iron doors. The ovens are surrounded on the two sides and bottom with combustion chambers, in which the volatile matter is burned as it passes away from the coal that is being coked in the ovens. The burning of this gas maintains a high and certain heat sufficient to coke the coal. It is claimed that the loss of carbon usual in coking coal in pits or bee-hive ovens is avoided, the waste gases being utilized to supply the heat for coking. There is a great saving in the new ovens in the small amount of labor required to discharge the coke and refill the ovens with fresh coal, not more than ten minutes being required for the entire operation.

The ovens are charged by means of hopper-filling trucks, which run on rails above the ovens. Each oven has two filling holes, so that the coal may be properly distributed in the oven. The discharge is effected by a powerful steam ram which moves to and fro in front of the ovens on a suitable railway. At the end of a long rack is a head, which fits the oven; this is pushed through the oven by aid of powerful gearing, and expels the coke from the door at the opposite end, the coke being left on the cooling ground on the other side of the oven; the ram is then withdrawn, the door closed, covers taken from the filling holes, and coal dropped in before the oven has had time to cool. The charge of an oven is about 8 tons, and in 72 hours this charge is coked, producing 6 tons in coke; the cost of labor is about 1s. 6d. per ton of coke produced; this is a yield from the coal of 75 per cent, and careful experiments have shown that coal from the same mine coked in pits and bee-hive ovens during the most favorable weather yielded but 60 per cent from the coal, at a cost for labor of 3s. per ton of coke. Taking the year round, however, the pits and bee-hive ovens yielded but 50 per cent from the coal. The coal in Jackson and Vinton Counties, Ohio, although existing in great quantities, has until recently been considered unfit for iron smelting, and it is through the application of modern improvements in the way of crushing and washing the coal, then coking it, that the great and beneficial result had accrued.

A NEW CROTON AQUEDUCT PROPOSED.

IN his report on the surveys, plans and estimates for a new aqueduct, prepared under a resolution adopted last summer by the Common Council of New-York, the Commissioner of Public Works makes a strong argument in favor of such an extension of our water supply.

The plans contemplate the building o a dam on Croton River, about one fourth of a mile above the head of Croton Lake, to an elevation of thirty feet above the top of the present dam, forming a settling basin of about 800 acres in extent, and a capacity of 1,180,000,000 gallons. Thence a tunnel is to be cut through the hills south of the Croton River, through which the water will be conveyed to the head of the aqueduct. The aqueduct is to be built on one of two routes—the Bronx River route, 36 8-100 miles in length, or the Saw-Mill River route, 36 52-100 miles in length—to High Bridge. The masonry aqueduct will not be continued beyond a point in the vicinity of Jerome Park, in the newly annexed territory, where it is proposed to build a receiving reservoir of a capacity of 550,000,000 to 600,000,000 gallons. The *niveau* of this reservoir will be 42 feet above that of the Central Park reservoirs, and from there the water can be carried in iron-pipes, the ground falling off abruptly towards the Harlem River, and rendering a masonry aqueduct impracticable. These pipes may cross the Harlem River either on High Bridge, which can readily be arranged for that purpose, or under the sidewalks of tunnels which the Department of Parks proposes to build under the Harlem River. In either case, it is claimed the expense would be comparatively small, and the pipes could be laid from time to time, as necessity demands. The new aqueduct is to have a capacity to deliver 150,000,000 gallons of water daily, thus increasing the supply by the two aqueducts to 250,000,000 gallons per day, with the additional and inestimable advantage of the elevation or head of the new supply of 42 feet above that of the park reservoirs, furnishing abundant water to the highest elevations in the city.

THE OIL-WELLS OF BAKU.

A CORRESPONDENT of the London *Daily Telegraph*, writing from Baku, on the Caspian Sea, describes the petroleum-wells of that region: "For two or three miles along the shore of the bay, the many works where the petroleum is refined by itself as fuel pour forth dense smoke, and at eight miles from the town lie the springs. The average depth at which the oil is touched seems to be about 150 feet; the wells are for the most part nine inches to a foot in diameter. From the one we visited a small steam-engine, with the most primitive gear, lifts about 450,000 pounds weight of petroleum in a day. The oil is of greenish-gray color, and is emptied into a pit carelessly dug in the earth, from whence men take it in buckets and pour it into skins and barrels, the charge at the wells being at the rate of 1½d. per 50 pounds weight of oil. At the works of the Kalafy Company, an Armenian concern, when their well was first opened, the petroleum burst up in a fountain nine feet in diameter, and was thrown forty feet into the air. At all the wells it is now raised by a circular tube about nine feet long and as many inches in diameter, with a valve at the lower end, which opens on touching the ground. This is lowered and raised by a steam-engine in about one and a half minutes. A man pulls the full tube toward a tub, into which it pours its contents, and from the tub the oil runs into the pit from which the skins and barrels are filled. I am assured that, while the Baku petroleum is of better quality than that of Pennsylvania, it is far less dangerous, because its flashing point of temperature is forty degrees higher than that of the American product."

The Baku petroleum is extensively used as fuel. "The engines of the steamboat which brought us here from Astrakhan were driven with petroleum; and it was the same ship, by the by, in which his Majesty the Shah traversed the Caspian. Coal, the captain told me, costs 18½ roubles per hour, while petroleum costs but 1½ roubles—a notable reduction this from £2 10s. to 4s. (from $12.50 to $1). In three or four years Baku will be united by railway with the Black Sea, and then probably all the ships on the Euxine will be supplied with the same disagreeable, but inexpensive fuel. The machinery reminded me of one of those pretty contrivances for blowing the spray of scent in a drawing-room. As the coarse residue of the petroleum—for it is that alone which is burned—pours in a thin stream from a tap at the mouth of each fire, a jet of steam blows it into spray, and thus it is consumed with an even heat throughout the furnaces of the engines."

CURIOUS BRAIN WOUNDS.

A FEW years ago an insane seamstress in one of our asylums made a practice of running needles into various parts of her person, several hundred being removed by the attending surgeons, before and after her death. The practice had been developed, apparently, from the employment of hypodermic injections for neuralgic pains.

The St. Louis *Clinical Record* reports a still more remarkable case of a man in Kansas who had a habit of running wires, and even nails, into his brain through holes made with a brad-awl. The habit was discovered during his residence in a penitentiary; and when he died subsequently of morphia a careful autopsy was made. Three openings were found in the skull, two near the inferior posterior angle of the right parietal, the other near the superior posterior angle of the same bone. In the brain was found a wire which had been thrust in at the upper hole, and, just missing the superior longitudinal sinus, had pierced to the base of the brain, a little in front of the fissure of Silvius. Beside the wire was a nail, one and three fourths inches in length. Although wires had been removed during life from the lower apertures, no trace of their course was discovered, no disturbance of brain function appeared to result from this strange habit. The prisoner could do his work with correctness and understanding; and, excepting a suicidal tendency, gave no signs of insanity.

The trial of Landis for shooting Carruth has given prominence to the power of the brain to withstand gun-shot and other wounds; but, barring the case of the Irishman who had an iron drill shot through his head and survived, we recall no case of brain lesion so remarkable as this.

DIAMOND STONE-DRESSERS.

CARBONITE has been applied to the dressing of freestone ashlar by fixing a number of diamonds in a gun-metal or steel block, and giving them a reciprocating and traversing motion over the face of the stone. This machine will dress from 600 to 1000 square feet per day, or as much as 100 or 150 men can do in the same time.

STEAM-POWER FROM SUN HEAT.

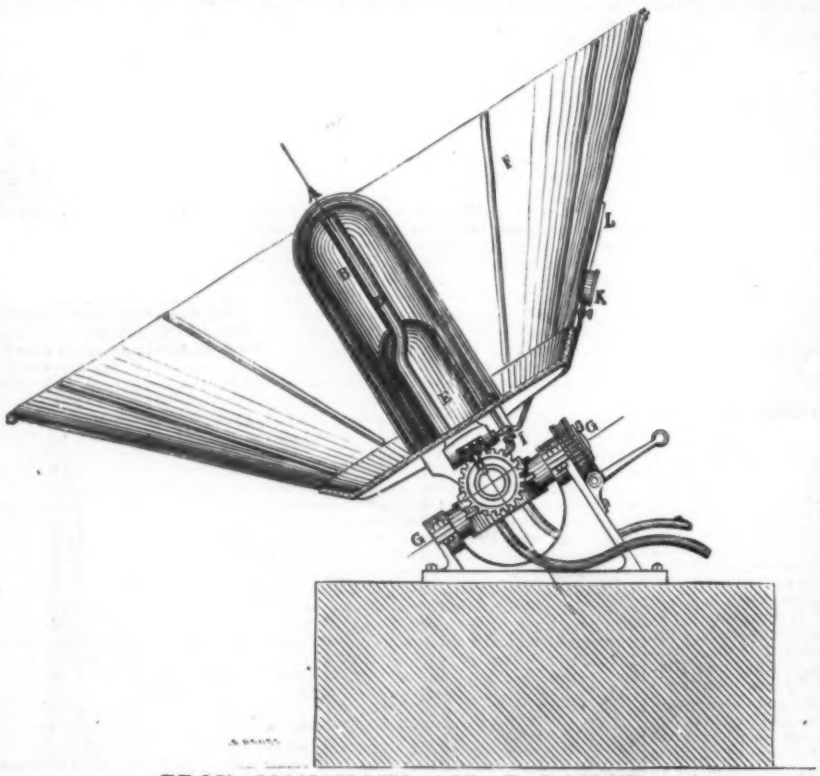
WE reproduce from our contemporaries, *La Revue Industrielle* and *Engineering*, an illustration and description of an interesting apparatus constructed by M. Monchot, Professor at the Lycée of Tours. This apparatus is, in fact, a solar boiler, and the letters upon the section refer to the following parts: A is a glass bell, B is a boiler with a double envelope, D is a steam-pipe, E is a feed-pipe, F is a conical silvered mirror; G G is a spindle around which a motion is given to the machine from east to west; H is the gearing regulating the inclination of the apparatus on the spindle G G, according to the seasons; I is a safety-valve; K is a pressure-gauge, and L is a water-gauge.

The construction of an apparatus intended to utilize the heat of the sun's rays depends on a more or less perfect knowledge of: 1. The amount of heat produced in a given time on a given surface by solar radiation; 2. The power of reflection and absorption of the different substances to be employed. According to Pouillet, if the atmosphere did not exist, there would fall per minute on each square centimetre of the great circle forming the base of the hemisphere lighted by the sun, a quantity of heat represented by the number 1.7633, taking as a unit the amount of heat required to raise one gramme of water from 0° to 1°. In passing through the atmosphere, from 21 to 28 per cent of the heat is absorbed, even in fine weather. Forbes and Kaemtz, at the end of long investigations, arrived at the conclusion that the amount of heat which reaches the earth in this climate is not so great as that named by Pouillet. On the other hand, the experiments of Sir John Herschel at the Cape of Good Hope led him to think that the solar heat, striking vertically, gave considerably less heat than was assigned at Paris by Pouillet. Probably if the amount of 10 calories be taken for this climate, it will be within the mark. The investigation of Melloni demonstrated that the quantities of radiant heat transmitted by a sheet of glass diminishes as the thickness of the glass increases. If a smoked metal plate be placed under a glass bell, the luminous rays will heat the metal, but the rays reflected from the plate will not pass through the glass; the black coating possesses to a high degree the faculty of absorbing the heat and light rays. Moreover, it resulted from the studies of MM. La Provostage and Desains that silver is the best reflector of solar heat, and that a silvered mirror reflects about 92 per cent of the whole. From the preceding data it appears to follow that in the construction of the solar boiler the apparatus should be placed under a glass casing, and silvered mirrors would be preferred for the concentration of the solar rays. The parabolic cylinder and the regular truncated cone produced by the rotation of an isosceles triangle, seem to be the best forms to adopt. These conditions have been carried out in the apparatus of M. Mouchot. It is composed of three distinct parts, the metallic mirror, the blackened boiler, the axis of which coincides with that of the mirror, and a glass envelope, permitting the sun's rays to reach the boiler, but preventing their return. The ratio of the heat utilized with the surface thus isolated increases with the extent of this surface. The mirror has the form of a truncated cone, with parallel bases, and the generating line makes an angle of 45° with the axis of the cone. This is the best form that can be adopted, because the incident rays striking parallel to the axis are reflected normally to this axis, and give a heat area of maximum intensity for a given opening of mirror. The reflectors are formed of 12 silvered sectors, carried by an iron frame in the grooves of which they slide. The diameter of opening is 112.3 in. at the top and 39.3 in. at the bottom, giving an effective mirror area of about 45 square feet. The bottom of the mirror is formed of a cast-iron disc to add weight to the apparatus. In the centre of this disc is placed the boiler, the height of which is equal to that of the mirror. It is of copper blackened on the outside, and is formed of two concentric bell-shaped envelopes connected at their base by a wrought-iron ring. The larger envelope is 31.5 in. high, and the smaller, 19.68 in.; their respective diameters are 11.02 in. and 8.66 in. The water is introduced between these two envelopes, so that it forms a cylinder 1.18 in. thick. The amount of water does not exceed 4.4 gallons, and about one third of the annular space is left as a steam-chamber. The inner envelope remains empty; it is furnished on one side with a copper pipe leading from the steam-chamber, and connected with the motor by a flexible tube. At the foot of the boiler is placed the feed-water tube. The glass envelope or bell is 15.75 in. in diameter, and 33.46 in. high, the thickness of the glass being .2 in. thick. A space of nearly 2 in. is thus left between the sides of the glass and the copper envelope.

Thus arranged, the apparatus is mounted on an inclined axis, the angle of which can be made to change to correspond with the motion of the sun, and a rotating movement of 15° per hour can also be given to it. To effect this double object, the apparatus is carried on trunnions resting on a shaft perpendicular to their axis, and this shaft forms, from north to south with the horizon, an angle corresponding to the latitude of the place. Two movements result from this arrangement which permit the apparatus to follow the course of the sun, since by a half revolution it turns from sunrise to sunset, whilst by an annual rotation of 46° at most on the trunnions, it is brought opposite the sun in all positions. This double movement is effected by means of worm gearing, the first being repeated at half-hour intervals, the second every eight days.

Experiments made with this apparatus at Tours showed that in 40 minutes 44 lbs. of water were raised from a temperature of 68° to 252°, and thence to a pressure of 5 atmospheres. In less than 15 minutes, 33 lbs. of water of 212° were raised to 307°. Finally, in favorable weather, 11 lb. of water have been evaporated per hour. The steam generated was employed for driving a pump.

The inventor of this ingenious apparatus points out various uses for which it may be employed, especially in warm climates, as, for example, for the distillation of water, either on shipboard or in rainless countries, for the manufacture of ice, in connection with the Carré apparatus for the distillation of alcohol, etc., and in the manufacture of sugar.



PROF. MONCHOT'S SOLAR BOILER.

[Catasauqua Dispatch.]

CORNWALL IRON HILLS.

ABOUT six miles south of Lebanon, and one hundred and sixty west from New-York, are the famous Cornwall iron hills, the richest in the world; they have made many millionaires in the past, and are still making them as fast as ever. Surrounding this vast deposit of iron ore is the largest landed estate in Pennsylvania, if not the largest east of the Alleghenies. It is made up of the Cornwall and Speedwell farms, containing 22,000 acres, and is owned by the heirs of Robert W. and William Coleman. It is reached from Lebanon over a fine, wide road, hard and level. The hills, three in number, are so rich in iron that millions of dollars could not buy them. They have been taking thousands upon thousands of tons from them yearly for the past quarter of a century, and as yet they are not off the surface. All the ore mining is done by daylight. They have no shafts, and there is no underground work. They have railroad-tracks all over the hills, and the cars are filled with the mineral scooped from the surface.

The hills are known as Big Hill, Middle Hill, and Grassy Hill. Big Hill is over 400 feet high, and has a base covering more than forty acres. It is shaped like a cone, and a spiral railway winds its way around it. Middle Hill is 200 yards from Big Hill. It is about 200 feet high, and covers about thirty-five acres. Years of constant mining have made little impression against its rugged sides. Ore was taken from it during the American Revolution to furnish cannon and shot, of which specimens are held at Cornwall to-day as relics. Grassy Hill lies southwest of Middle Hill, at a distance of 100 yards. It has been worked for more than twenty years, is nearly 150 feet high, and covers about thirty acres. These vast deposits were purchased with the rest of the estate many years ago for about $675. Here, too, are situated the summer residences of the owners of the estate, who live in regal splendor.

The ore is at present mined by the Cornwall Ore Bank Company, with J. Taylor Boyd, a practical miner, as superintendent. The metal is a magnetic oxide, containing a large proportion of iron pyrites, which under atmospheric influence changes from the sulphuret of iron into a sulphate soluble in water, and is washed away by the rain. The nearer it is to the surface the freer it is from sulphur. One of the most complete iron furnaces in the world is built here. It is called the "Bird Coleman" furnace. It is of stone and iron, and cost about $350,000. It has a capacity of about 250 tons of pig metal per week. It was completed on the day of Jay Cooke's failure. There are also eight other furnaces, all connected by rail. On this estate is the best paying railroad in the world. It is six miles long, leading from the Hill to the Lebanon Valley railroad, which runs east and west, connecting Harrisburg and Reading. Twelve years after ground was first broken, the receipts of the road paid for its construction, equipment, annual running expenses, and repairs. It is purely a private freight road built by the Colemans. Copper is also found on the estate, and is sent to the U. S. mint to be converted into coin.

The Cornwall farm contains 15,000 acres. It is not divided into distinct tracts, but is one continuous piece of land, of which 105½ acres are taken up by the ore hills. The rest is in a high state of cultivation. There are fifty miles of road on it in constant use. The entire estate is under the control of one overseer and his six assistants. The tenantry number about one thousand, men, women, and children, who live here happy and contented. The stranger is reminded by their appearance of the estates and tenantries of Great Britain. The workmen are paid in cash every month. They can purchase at the store of the estate much cheaper than at the city shops. They buy their flour, corn, etc., at greatly reduced prices at the large mill of the estate. They have a fine church, post-office, and school, as well as other necessary buildings. The soil is rich and has immense deposits of limestone. There is a brickyard and a large sandstone quarry. They have their own carpenters, blacksmiths, and other artisans, and they will shortly weave their own cloth from the wool which they raise. Cornwall will then be a complete little world in itself, almost entirely independent of outside help.

The Speedwell division is a part of the estate devoted to stock-raising, which is made a specialty. Hundreds of the best draught-horses and roadsters and the choicest cattle and sheep are to be seen here. George Youtz has charge of the stock farm. Its chief attraction is its magnificent stud, containing Middleton, a half brother to Bonner's Dexter. He is a bay, 15¼ hands high; $25,000 has been refused for him. He has a record of 2.30, is thirteen years old, and has forty descendants, among them Orange Blossom, with a record of 2.16¼, and Katie Wink, which was sold, with mate, to a Californian for $30,000 in gold. None but short-horn cattle are raised. One of the two herds of Holstein cattle in the United States is here. The Southdown sheep are raised here in great beauty and perfection.

The estate is a tenancy in common, owned by about ninety-six persons, who live in New-York, Paris, London, Philadelphia, and other large cities, and at Cornwall. The profits are divided annually. Mr. A. Wilhelm is the manager.

ON THE ELECTROLYSIS OF SUBSTANCES OF THE AROMATIC SERIES.

By M. GOPPLESRŒDER.

I HAVE been occupied since the end of last year with researches on the electrolysis of the aromatic substances. The note presented to the academy by M. Coquillion on the 30th of August last, concerning the direct formation of aniline black by the electrolysis of two salts of aniline, determines me to publish the results which I have obtained myself. I have observed the formation of an aniline black obtained directly from the oxidation of aniline by electrolytic oxygen; it has a metallic lustre, like the color of aniline in general, and gives upon paper a complete black coloration. I have directed my attention to bodies of the most distinct groups of the aromatic series; I have entertained the committee of the Industrial Society of Mulhouse with the difficulties which present themselves in the electrolysis of organic bodies, and the precautions to be taken. I have signalized the influence of the temperature, of the concentration of the liquid, of the pressure under which electrolysis takes place. I have insisted on the importance of making thorough trials on the simultaneous employment of electrolysis and dialysis on galvanic decomposition at high pressure in close vessels. I have shown that we do not arrive always by electrolysis at the same results as by decomposition by means of chemical agents. That instead of employing the electrolytes alone, one may also employ a mixture with other bodies, so that in consequence of the electrolytic decomposition the radicals of the substances may react upon each other. I attribute a great importance to such experiments, not only for chemical theory, but also for analysis and industry; for the fabrication of chemical products, and especially of coloring matters. I am convinced that we shall succeed some day in making use of electrolysis for dyeing and calico-printing.—*Comptes Rendus.*

ACTION OF ELECTROLYTIC OXYGEN ON GLYCERIN.

By A. RENARD.

GLYCERIN diluted with two thirds its bulk of water acidulated with $\frac{1}{10}$ sulphuric acid, and submitted to the action of electrolytic oxygen, furnished various products, among which were noticed formic and acetic acids, glyceric acid, a primary glyceric aldehyde, and a syrupy body without action on carbonate of lime or baryta, but yielding with caustic baryta, a body insoluble in alcohol—probably the acid corresponding with the second glyceric aldehyde, its formula being $(C_3H_4O_4)_2Ba$. These substances have not been perfectly examined, owing to the smallness of the quantities obtained. The glyceric aldehyde is a white, amorphous, hard, brittle body, of penetrating odor, recalling that of formic acid. It melts at 92°, and at a higher temperature volatilizes, with slight decomposition. Its formula is $C_3H_4O_4$. It is slightly soluble in water, nearly insoluble in alcohol and ether. Its aqueous solution reduces ammoniacal silver nitrate, forming a metallic mirror; yields crystals containing 36–37 per cent of nitrogen, when evaporated, after addition of ammonia; and evolves heat when mixed with sodium sulphite. Nitric or chromic acid oxidizes it to formic acid; ozone converts it into acetic acid; electrolytic oxygen converts it into a mixture of those two acids; and if mixed with a little water and exposed to the air, it affords a viscous mass, closely resembling that formed by the direct action of electrolytic oxygen on glycerin.

SEWERAGE AT BOSTON, MASS.

THE commission appointed to consider the sewerage of the city recommend an entirely new system. They propose two main sewers, encircling the city on the land side, discharging into two reservoirs at a low level; one on Breed's Island, opposite Chelsea, the southern on the shore of Dorchester Bay. From these reservoirs the sewage is to be pumped into outfall-sewers which are to be extended out to near the harbor entrances on each side. Branch sewers are planned to deliver the sewage of the various quarters of the town as directly as possible into the mains. The estimates of cost of the various main sewers, branches, reservoirs, pumping-engines, and outfall-sewers, are for the northern section about two and three quarters millions of dollars, and for the southern section, which would drain the whole of the old city, about three and three quarters millions

BEAUTIFUL HOUSEHOLD ORNAMENTS.

BEAUTIFUL HOUSEHOLD ORNAMENTS.

By GEO. M. HOPKINS.

NOW that so many artisans and mechanics are unemployed, and so many are anxious to dispose of their time to some profit, or at least legitimate pleasure, I venture to suggest a plan by which several household ornaments may be made, with few tools, and without expense; and if the directions are faithfully followed, whoever tries will feel well repaid for time and trouble.

A beautiful imitation of the much prized antique bronze vases and urns may be made in the following manner:

Turn a vase of any desired design from well-seasoned maple or other suitable wood. Handles, knobs, rings, pendants, etc., may be turned and added. Give it several coats of black varnish (shellac preferred), rubbing it down with fine sandpaper and for the last time with a well-worn piece. When the grain of the wood is well filled, such places as are to be ornamented with bands of fret, carved or knurled work, are to be fitted with strips of cotton lace or edging. The parts which are to receive this ornamentation are varnished with a thin coating of shellac varnish, and allowed to stand for a few moments, when the cotton lace or edging being pressed on will adhere.

In the centre of the beads or bands, or in the edge of the rim of the article, a groove may be turned and a cord having a well-defined twist fastened therein with shellac. The varnish must now be allowed to dry thoroughly.

A medallion or other fine ornament for the sides may be found in stamped stove ornaments, in brass buttons, or in the so-called sawdust and glue ornaments which are used to adorn furniture, etc. These may be neatly put on or let in, as the case may require.

The lace is now to be well filled by giving it several coats of shellac varnish. When this becomes dry and hard, the whole vase is to receive a coating of quite thin, plain shellac varnish having a sufficient quantity of fine plumbago stirred in to give it a metallic appearance. When this coat is dry, the whole vase is to be polished with fine plumbago, rubbed on dry with a woollen cloth or stiff brush until a fine lustre is obtained. Now coat the article with a lacquer made from plain shellac varnish having in it a considerable quantity of tincture of turmeric and dragon's blood. This gives it a dark bronzed appearance.

Powdered verdigris is mixed with turpentine, and a very small quantity of furniture or turpentine varnish is added (not enough to give the mixture any lustre). This must be brushed into the interstices of the cotton lace and all the creases, and under portions of beads, bands, and ornaments. The verdigris remaining on the projecting portions must be wiped off clean before it can set so as to make it impossible. Should it adhere so as to make it difficult to remove it, a little turpentine may be put on a cloth, and with this it may be readily wiped off. A base-piece to imitate the usual marble base may be turned from wood, and dyed or painted black, and polished in the lathe, and added with good effect.

The subscriber has made ornaments in this manner, which have passed for bronzes under quite close inspection. Very few have recognized the cotton lace even after the article is known to be made from wood.

Among the articles which may be made in this manner are, card-receivers, brackets, match-safes, picture-frames, etc. A host of other articles will suggest themselves, and so also will other plans for ornamentation. For instance: symmetrical paper figures, dried natural leaves, small shells, etc., may be attached and treated in the same manner as the cotton lace. A pleasing variety may be made by using bronze-powders of various shades.

THE PHYSIOLOGY OF FATIGUE.

WORK results in fatigue, and fatigue is a regular and constantly-returning symptom experienced by all of us. Periods of functional activity invariably alternate with periods of repose, during which the waste caused by the exercise of function is repaired. We are indebted to Sir James Paget for having pointed out that "rhythmic nutrition" is a law of nature. Our whole life consists of a series of vibrations—periods of tension alternating with periods of relaxation; and although the rapidity of these vibrations varies immensely, they are recognizable in all our acts, be they voluntary or involuntary. Let us look first to the "vibrations" of an organ, the movements of which are placed entirely beyond our own control—the heart. Now, the rate of vibration of the heart is 72 per minute, and if the total period of each vibration be divided into ten parts, it will be found that four of these parts are devoted to the process known as *systole*, which may be looked upon as labor; three are occupied by the *diastole*, which, although hardly labor, is nevertheless exercise of function; and the remaining three parts are occupied by the *pause*, during which the heart apparently enjoys absolute rest from any exercise of function, and may be considered to be in a condition analogous to sleep. May we not apply the rate of action of this organ, which has been regulated for us, to our voluntary acts, and may not the heart be made to give the key-note, as it were, to many questions personal and social? If we divide the day of twenty-four hours into ten equal parts, and give four of these to active work, three to functional exercises of other kinds, and three to sleep, we shall find that nine and a half hours' work, seven and a quarter hours' "relaxation," and seven and a quarter hours' sleep, is what a normal man may perform without injury to himself.—*Lancet.*

THE ENGLISH CHANNEL PASSAGE.

THE London *Times*, of December 31st, says: "Yet another attempt at the solution of the Channel passage question has recently been made by Mr. Hugh A. Egerton, with a model of whose system some experiments were made yesterday on the lake at the Welsh Harp, Hendon. Mr. Egerton's plan consists in using what may be termed an immense floating platform, propelled by paddle-wheels. The structure is composed of three main longitudinal iron cylinders, each 600 feet in length by 26 feet in diameter at the centre, tapering off to a point at each end. The cylinders are divided up transversely into a number of water-tight compartments, each properly staged. The cylinders are placed seventy-eight feet apart, and are connected on the top by means of a series of wrought-iron girders twenty feet deep, thus presenting a platform or ferry 600 feet long by 234 feet wide. On the level of the lower flanges of the main girders will be a deck carried on cross-girders, the upper deck being carried on the top flanges. The space between the decks will be appropriated to saloons, cabins, engine-rooms, and other necessary offices, while the upper deck will be appropriated to railway-trains, which are to be transported bodily across the Channel from the various railways on either side. The diameter of the cylinders is calculated to be exactly double the height of the highest channel wave, so that it is expected that no wave will touch the under side of the lower deck. The ends of the tubes are made to taper so as to cleave the water readily and to act as breakwaters to diagonal waves. The whole arrangement will be boxed in between the two decks, and will be made as snug and as comfortable as possible. On each tube, central of its length, will be placed the engines, with a pair of paddle-wheels to each engine, steam being taken from two boilers, one being placed in each space intermediately between the tubes. Arrangements are, of course, made for steering the ferry. The model with which the experiments were made yesterday was 12 feet long by 6 feet wide, and was fitted with boilers and engines arranged as described. The steaming qualities and floating power of the model were demonstrated directly it was placed upon the lake. Unfortunately, however, the experiments had not proceeded far when one of the boilers gave out, and the experiments were brought to a termination. Mr. Egerton's system will, of course, require special landing-places on either side of the Channel, with arrangements for shipping and unshipping the trains. Another proposition of Mr. Egerton's is to construct vessels upon his principle for the transport of cattle from across the Atlantic. For that purpose the central tube would be dispensed with, and several other modifications would be introduced. No doubt Mr. Egerton would succeed in obviating sea-sickness on the Channel by his scheme, although it is one which must involve considerable expense in the new works it will necessitate."

ICE PROSPECTS.

REPORTS FROM ALONG THE HUDSON—ICE STATISTICS.

So far this winter no ice has been gathered along the Hudson River, and as the season has advanced considerably, with continued unfavorable weather, the prospects for a full crop are considered poor. The season for storing ice generally commences about the end of December and ends when the houses are filled, early in February. All the large ice companies and dealers were about to commence the harvest at the usual time this season, when the mild weather came and destroyed the ice which had formed up to that time.

With the exception of a large space near Cosymans and New-Baltimore, where the ice blocked up and is about a foot thick, the ice at most points between this city and Catskill is only from two to four or five inches thick. Below Catskill the river is broken ice or entirely open. It is expected that the Knickerbocker Ice Company, of New-York, will, if the weather is favorable, soon commence operations near New-Baltimore.

The storage capacity of this company's ice-houses is nearly 1,000,000 tons, the different houses varying in capacity from 6000 to 60,000 tons. The ice-houses of the other principal companies are about the same, and all are located on or near points on the river and at such lakes as are accessible by railroads.

The ice crop of the season of 1874–5 along the Hudson was estimated at 2,500,000 tons, and was never before equalled, the whole having been gathered by the first week in February. Some of the ice-houses are filled more than once a year, the sale continuing to a moderate extent throughout the winter months.

The stock of ice on hand is, from all accounts, about the same as at a corresponding period a year ago. The Knickerbocker Ice Company usually stores nearly double the amount of all the other companies and private concerns put together, and during the ice harvest employs from ten to twenty thousand men, whose wages average from $1.25 to $1.50 per day.

There are probably from 6000 to 8000 men along the Hudson waiting for the work of gathering ice, and considerable suffering is reported among some of them. The ice dealers of this city have on hand a considerable quantity, and in the poorest seasons manage to obtain a good supply, although obliged to secure it from remote points.

The ice business has grown up from small beginnings to be one of the largest minor industries of the country. It employs a capital of over $20,000,000, and the aggregate sales of ice are more than $30,000,000. Forty years ago the capital invested was less than $100,000, and the aggregate sales not more than $125,000.

Over one hundred thousand tons are exported to Southern cities and foreign countries. As many persons are aware, the ice-houses are huge buildings, from one to two hundred feet in width, and from two hundred to four hundred in length, generally of wood, though sometimes of brick, with double, triple, quadruple walls, the interstices packed with some non-conducting substance, such as spent tan bark, sawdust, etc., with doors closing tightly on each floor, but no windows, and with inclined planes movable and adapted to each story, without as well as within, and in the case of the larger houses a steam elevator is employed to drag the blocks up the inclined planes and lower them on the inside. During the harvest season the work of gathering ice is pushed vigorously, and at some of the large ice-houses 000 tons are harvested in an hour.—*Albany Journal.*

TINNING OF IRON TACKS.

ZINC chloride is rubbed up with a large quantity of oil, and heated in an oscillating pan. As soon as the contents have attained the right temperature, the tacks to be tinned are thrown into the pan, together with the proper quantity of metallic tin. The tacks are allowed to remain therein for a *few* seconds, and are then withdrawn with a wire net, and cast into water.

THE SPIRITUALISTS OUTDONE.

IN his correspondence to the London *Times*, Dr. Russell describes the performances of some Indian jugglers and snake charmers before the Prince of Wales. The planting of a mango seed was followed by some tricks with cobras by a vivacious old juggler and a ragged confederate. Meanwhile the mango under the dirty cloth was growing, and in an interval of snake work the old fellow dashed at the latter and exposed a fresh bright green mango tree some eighteen inches high in the ground, where he had apparently only put in a mango seed. Expressions of wonder followed; then the cloth was thrown over the tree and another of the famous legendary legerdemain feats was executed. A shallow basket about eighteen inches high and three feet long, with a cover, was placed before the Prince. It was plain there was no deceit. At a call there came out from the group of natives near at hand a lad of twelve or so, slight of figure and pleasant of face, with not an article of dress save his loin cloth and a dirty turban. Him the old man, chattering the while, bound hand and foot *à la* Brothers Anyone in twine. Then a sack, made of strong netting, was produced, and the old fellow slipped it over the lad, whom he squeezed down on his haunches so that he could tie the cords securely over his head and lift him from the ground to prove how secure he was. He seemed to use great force to put the lad into the basket, and to have much difficulty in fitting the lid on the top of him. When that was done the music was renewed by one, and the other juggler began to talk to his basket. Presently the lid was agitated, and the cord and net were jerked out and fell on the ground. Then the juggler ran at the basket in a fury, jumped on the top, crushed in the lid, stamped on it, took a stick and drove it with force through the wicker work. The basket was empty. Then there came a voice as of the lad who had been inside, and lo! there was just such a youth upon one of the trees. The mango tree, when next uncovered, appeared hung with tiny fruit.

AMERICAN BEEF IN ENGLAND.

THE Williams & Guion Line are devoting considerable space and attention to the exportation of American dressed beef to the London market, and already the Dakota, Wyoming, and Nevada have been fitted up with Batison's refrigerators, which have a capacity of 400 to 650 quarters of dressed beeves. The Nevada took out 624 quarters in a refrigerator, located on the main orlop deck, and occupying a space of 40 feet long, 28 feet wide, and 7 feet 9 inches high. On the port side of the space is an ice-house, holding forty tons, and by means of a small engine, located outside of the refrigerator, a blower, inside of the space, is driven up to any required speed, forcing a current of air at about the temperature of thirty-eight degrees across the deck, through a tubing which connects with one running fore and aft on the starboard side, connecting again with four uptakes or outlets. The cool air is thus forced over the top of the quarters, which are suspended from hooks in the ceiling. The arrangement is perfectly simple, and thus far has worked to a charm, so that beef has been delivered in the New Smithfield Market, London, in first-class order, at about sixpence per pound, to go into competition against British beef, at from fourteen to sixteen pence per pound. The American beef is eagerly sought after, and the demand is so steadily increasing that it is not at all unlikely that, for the future, dressed American beef will form a part of every shipment by the regular lines leaving this port. The shipments are under the supervision of Mr. Eastman, one of our largest butcher firms, and the returns made to him are very gratifying indeed.—*Nautical Gazette.*

MILITARY IDLERS.

THE number of men at present maintained in the standing armies of civilized nations is not less than 3,000,000. All these are snatched away from useful industries and condemned to idleness and a vicious life, while the laboring people are taxed for their support and for the costly armaments they require. The annual amount of the military and naval budgets of Europe is $596,963,300; the loss of labor involved by the withdrawal of so many men from productive industry costs $660,874,460; and the interest of capital invested in military and naval establishments amounts to $152,200,000. This makes a total of more than $1,400,000,000 taken every year from the people of Christendom for the maintenance of military establishments. But this is not all; for nearly as many more men are required to wait upon them in some form or other, and they, too, become consumers of the world's supply of food. The first effect of this is that the finances of nearly all European States are embarrassed. On the other hand, let us for a moment suppose that, by an understanding with the great powers, a disarming in the proportion of one half was effected. Immediately more than 2,500,000 of men, from twenty to thirty-five years of age, constituting the flower of the population of that age, are restored to the labors of peace, and at once an annual saving of $640,000,000 is effected on the totality of European budgets—a sum which would pay off in twenty years all the European national debts.

IT appears that Lieutenant Cameron's expedition across Equatorial Africa was not so completely successful as first reports seemed to indicate. A later dispatch to the London *Telegraph* states that he followed a large river flowing out of Lake Tanganyika in a southwesterly direction, tracing its whole course till he came upon a new lake, which he named "Livingstone." From this body of water a second large river runs westward, which the Lieutenant, having traced it for a considerable part of its length, believes to be the Congo. He was unable to continue along the river on account of meeting with a tribe of hostile natives. He had to choose between fighting his way through, with the risk of losing all his journals and papers, or of taking a different direction. The latter alternative seemed preferable, and though it prevented the absolute verification of his important discovery, he has personally no doubt that the stream flowing out of the Livingstone Lake and the Congo are one and the same.

THE Pope has been building in Rome at his own expense a number of houses for the poor. They are called economical houses, and are for the accommodation of operatives and poor people. Each house is divided into 32 lodgings, of two, three, or four rooms. Each lodging has a kitchen. They are well ventilated and full of light; the doors have good locks; there are bells, and the whole construction is solid. The rent of these lodgings is from 12 to 20 francs a month, according to the number of rooms. The rent is paid by the month, and without any demand of deposit in advance or as security.

THE COAL TRADE.

THE carriage of anthracite coal by the Pennsylvania Railroad, the past two years, has been as follows:

	1874. Tons.	1875. Tons.
Delaware and Hudson Canal Co.:		
Years ended December 31st	2,399,417	3,056,479
Increase		657,062
Pennsylvania Coal Co.:		
Years ended December 31st	1,338,663	1,368,207
Increase		29,544
Lehigh and Susquehanna Division Central Railroad of New-Jersey:		
Years ended December 31st	2,972,287	2,661,635
Decrease		310,652
Belvidere Division Pennsylvania Railroad:		
Years ended December 31st	1,227,909	767,019
Decrease		460,889
Delaware, Lackawanna and Western Railroad:		
Years ended December 31st	2,570,437	3,326,901
Increase		756,469
Philadelphia and Reading Railroad:		
Years ended November 30th	6,348,812	5,505,454
Decrease		843,358
Lehigh Valley Railroad:		
Years ended November 30th	4,150,659	3,277,571
Decrease		873,087
Pennsylvania and New-York Railroad:		
Years ended November 31st	714,030	748,072
Increase		34,042
Shamokin Division Northern Central Railroad:		
Years ended December 31st	590,129	768,873
Increase		176,844
Summit Branch Railroad:		
Years ended December 31st	446,462	523,060
Increase		76,598

THE FRUIT PRODUCTS OF SOUTHERN CALIFORNIA.

FOR horticulture and fruit-raising this country is unequalled. Oranges, lemons, limes, citrons, figs, olives, grapes, apricots, nectarines, etc., are grown in abundance, the yield in oranges and lemons being immense and valuable. In 1874 there were 90,000 orange trees in the state, of which Los Angeles County had 34,700, but the present number is much in excess of these figures. The trees are planted forty or fifty to the acre, and yield from 1000 to 3000 oranges each, which, at the low price of a cent each, give a comfortable income. One needs capital to start an orange orchard, however, for the trees only bear in twelve years from the seed, and trees from the nurseries are expensive. The lemon tree bears all the year round, and many trees yield $100 per annum, although they require sixteen years to mature from the seed. The olive, introduced by the missionaries, some of whose trees, planted one hundred years ago, are still bearing, is a profitable crop, and there are 12,000 trees in the State, producing fruit of a superior quality both for pickling and yielding oil. The almond, pomegranate and English walnut are also grown successfully.

The leading industry, and the one with the brightest future apparently, is the grape culture, the leading varieties being the Mission, White Muscat, Flaming Tokay, Rose of Peru, and Black Morocco. Los Angeles County leads the State in this industry, having 4,250,000 vines, and producing 1,500,000 gallons of wine and brandy yearly, or 37 per cent of the entire product of the State. And yet the industry is only in its infancy in this county, and many square miles of vineyards will soon be planted. The yield per acre is from 7000 to 15,000 pounds, and the White Muscat has been known to yield a paying crop the second year after planting. This variety is also converted into raisins successfully, an acre producing 12,000 pounds of grapes, furnishing 4000 pounds of raisins, worth 10 cents a pound.—*Los Angeles Herald.*

PROPOSED CONVERSION OF MANCHESTER INTO A SEAPORT.

THIS is the age of immense engineering enterprises; and with telegraph communication literally extending from "China to Peru," the Mediterranean and the Indian Ocean connected by an artificial water-way, and England and France in a fair way of being united by a tunnel, the project of turning Cottonopolis into a seaport can not seem such a great matter as it would have appeared a generation ago. Indeed, just a century has elapsed since the people of Glasgow cautiously and tentatively, as it is the wont of their countrymen, commenced a similar undertaking, which has become a great success, large ships now coming up into that city and discharging at a wharfage which extends upwards of three miles, the harbor dues bringing in a clear income to the corporation of at least $750,000 a year, after providing for dredging and all other expenses. The promoters of the Manchester scheme propose to strengthen, deepen, and widen the river Irwell from below the town downward to its junction with the Mersey, and to apply the same process to the latter river thence to below Liverpool. Thus a tidal channel will be provided from the vicinity of Manchester to the sea, thiry-three miles in length, two hundred feet in width, and with a minimum depth of twenty-two feet. The ships will be brought up by means of tugs in the same way as they are hauled through the Suez Canal. The increased capacity of the channel will carry off floods as well as greatly increase the flow of tidal water, and not only augment the scouring action of the river higher up, but also act beneficially on the bar at its mouth. The total cost of the undertaking is estimated at three millions and a half sterling, not too large a sum for the advantages that may be expected to accrue to the town and trade; while, if we may judge from the case of Glasgow, it would offer a highly profitable investment for those who may supply the capital.—*Iron.*

REMEDY FOR RED SPIDER AND THRIPS.—A correspondent of the *Gardeners' Magazine* states that a mixture made up as follows has been found very efficient in destroying these pests: Scald 2 oz. of the best shag tobacco in a quart of boiling water; then add four tablespoonfuls of spirits of turpentine and 1 oz. of bitter aloes; cover closely, and let the mixture stand to draw for half an hour. Then put 8 oz. of soft soap into a gallon of hot water, and keep it well stirred until it is all dissolved; then mix the two lots together, and when cold strain and add sufficient water to make four gallons.

HOW TO HANDLE SNAKES.

MR. NICHOLSON, in his excellent book on Indian ophiology, has very truly pointed out that even the deadliest snakes may be taken up with impunity by those who have nerve and quickness of touch. Unless frightened or hurt, they are remarkably slow to exercise their power. They seem to have an instinct which warns them to economize it for a real extremity; for once spent by angry striking, the cobra, it seems, must have time to collect his lethal force—not, however, his venom, for he ejects but a drop of that at each stroke. Mr. Nicholson says: "I have often envied the nerve of a man here who puts his hand into a narrow-mouthed basket containing several fresh cobras, and picks out the one he wants, without the slightest objection on the part of the snake beyond a furious hissing." The great thing is, in fact, not to terrify the terrible *naga;* and half the mystery of the business stands explained when this odd amiability in the deadly cobra is understood, and the perfectly collected manner of the charmers is also observed. The snake, judiciously handled, seems to know he will not be hurt, and even when he emerges, indubitably fresh and fatal, from his hole, it is a lesson which Rarey would have treasured to see how the charmer presses his head quietly to the ground, and takes him up calmly and smilingly, hissing and expanded, though one-sixteenth of an inch of that curved needle-tooth driven in earnest is death beyond hope. In illustration of this curious good temper in poisonous snakes, we may mention that the Hindoos have little or no fear of them. It is considered rather lucky to have a cobra in the chuppur of the hut, and the children put out milk and eggs every night for 'their uncle,' who keeps down the rats, and will live a whole season about the place without doing any kind of harm."—*Once a Week.*

MUSICAL SPIDER.

MR. WOOD-MASON exhibited specimens of a gigantic spider belonging to the genus *Mygale*, which had the power of emitting a loud, stridulating sound, and stated that that interesting discovery had been made by Mr. S. E. Peal, of Sibságar, Assam, who, at his request, had drawn up a most graphic account of his observations on the living animal. Mr. Mason had himself undertaken to ascertain the position and to describe the structure of the sound-producing apparatus, which he had found to consist of a *comb*, composed of a number of highly elastic and indurated chitinous rods, situated on the inner face of the so-called *maxillæ*, and of a *scraper*, formed by an irregular row of sharp spines on the outer surface of the *chelicerœ*. This apparatus was equally well developed in both sexes, as in most Coleopterous insects, and was not confined to the males as in the Orthoptera, Homoptera, and the stridulating spiders (*Theridion*) observed by Westring, in all of which the exclusive purpose of the sounds emitted seemed to be to charm or call the opposite sex.

In conclusion, Mr. Mason discussed the probable purposes of the sounds emitted, and pointed out how the *Mygale stridulans*, as he proposed to call the species observed by Mr. Peal, differed from its nearest ally *M. javanensis*, in which no stridulating organs were developed.—*Proc. As. Soc. Bengal*, November, 1875.

COLORADO SODA.

ABOUT twelve miles southwest of Denver, near Morrison, the Burdsal Soda and Manufacturing and Chemical Company has erected a stone building, 104 feet long by 20 feet wide, for evaporating. The pans are being put in place, and from five to eight tons every twenty-four hours (it is estimated) of sulphate of soda will be produced. In addition, a second building is being erected, in which will be furnaces to desulphurize the sulphate of soda with lime, then lixivate, then evaporate. The product will be carbonate of soda, soda ash. The pl-product will be sulphide of calcium, which will take the place of quicksilver in mining, and be a saving of 20 per cent in the production of the precious metals; the sulphide of calcium will not cost as much as the waste and loss of quicksilver by handling. The company will, as soon as practicable, erect additional buildings to manufacture bi-carbonate of soda; also caustic of soda and hypo-sulphate of soda, to precipitate the chloride of silver that is held in solution, which has been a loss of 15 to 20 per cent to mill-men. The soda ash will be used for glass and soap, it is also one of the best fluxes for our gold and silver ores. Dr. Burdsal's estimate is that the company can manufacture of the different kinds of soda from 1000 to 1500 tons the first year.—*Colorado Farmer.*

PRACTICAL CREMATION.

THE new *Crematorio* or establishment for practical incineration, at Milan, the first large and thorough institution of the sort attempted in the world, was consecrated, opened or inaugurated lately with the solemn cremation of the remains of the Chevalier Albert de Keller. The establishment is provided with the latest and best furnaces, and intending patrons of both sexes may rest assured that they will not be exposed to any of the disagreeable incidents which attended the recent cremation of Lady Dilke in Germany. What with the Italian Professor at Florence who has perfected a method for converting the human body into a solid, smooth, and enduring statue, and with this Italian cremation in the splendid Lombard capital, it is evident that Italy is now the best country in which a person of positive æsthetic tastes can die. It has long been one of the best countries in which a person of positive æsthetic tastes could live.

LARGE PEARS.

AT the Royal Horticultural Society's fruit show, held on November 10th, there were staged some very large examples of Uvedale's St. Germain pears. These all came from Jersey, which annually furnishes the largest examples that come into the market. The six heaviest fruits weighed 14 lb. 5 oz., and two other half-dozens weighed respectively 12 lb. 12 oz. and 10 lb. At the present time there may be seen in the window of Mr. Soloman's shop in Covent Garden a dozen of these monster pears, which are for sale at the fancy price of £30. The prices for these exceptionally large fruits seem to be gradually going up, as only a few years ago much more highly-colored specimens were only estimated at the value of one guinea each. Where there can be a demand for such pears it is difficult to say, for at the best they are only fit for stewing, and for that purpose we think the Uvedale's St. Germain, or, as the French call it, Belle Angevine, is well beaten by the smaller but more useful Catillac. The story goes that they are in great demand to lend out for dinner-parties, and who knows but that it is true.

[Agricultural Gazette.]

POTATO-GROWING EXTRAORDINARY.

MR. FORD, gardener, Capesthorne Hall, Chelford, near Crewe, has recently explained how he obtained the extraordinary weight of 1082½ lbs. of potatoes from 1 lb. of seed. On a piece of ground, 84 ft. by 32 ft., he put about 6 cartloads of charcoal dust, lime, rubbish, and old mortar, and a liberal dressing of manure from hotbeds. The ground was then dug in the usual way, care being taken to make it as fine as possible. When the surface was sufficiently dry, trenches were marked out for celery, 15 inches wide, the spaces between being 33 inches. The spaces between the trenches were then treated to a slight dressing from an old mushroom bed, and dug again, so as to thoroughly incorporate the manure with the soil. The trenches were taken out in the usual way, and when completed the tops of the ridges were exactly 2 feet wide. There were eight trenches and seven ridges, and on six of these ridges he planted the pound of Eureka potatoes that produced 1082½ lbs. Mr. Ford purchased 2 lbs. of this variety from Messrs. Hooper in March, and on receiving them they were placed in seed drawers, with the base of each tuber uppermost; his notion for so doing was to encourage the eyes at that end to start at the same time as those at the other, or what is termed the growing end. This they will not do if laid on their side, or with the growing end upwards. They were slightly syringed with warm water daily, and soon began to grow. When sufficiently forward he examined all the tubers, and carefully removed with the point of a knife the centre bud from each eye. This shoot was of no use for planting; his object in removing it was to induce more than one to grow from each eye. This answered very well, for when the potatoes were cut into sets, he was able with great care to cut three, four, and in some cases, even five sets from one eye. As he had 2 lbs. of tubers, he examined them to see from which tubers he could obtain the greatest number of sets, and then invited a number of persons (almost a score) to see them cut and weighed, and to count them at the same time, that there should not be even a semblance of unfair dealing. The number of sets obtained in this way was 252. Of course the sets were ridiculously small, many of them not being so large as horse beans. On the following day (April 13) the potato sets were planted, 2 feet asunder, down the centre of the ridges, and counted again at the time of planting. In a little over a fortnight they began to show above ground, but were so remarkably weak at first that he was ashamed to show them to any one. Early in May he gave each plant a light dressing of guano, stirring the soil about them, and giving a good watering at the same time. This was repeated twice, at intervals of about 10 days, while the weather remained hot and dry. They were earthed up twice, the last time leaving the ridge as sharp at the top as is done with celery. So surprisingly did the haulms extend that by the middle of July they met across the celery trenches, a distance of 4 feet, and he saw that, if left alone, the celery (which had been planted in June) would soon be killed altogether by its stronger neighbor. The celery being a more important crop to him than the potatoes, he was compelled to keep the latter within bounds by driving stakes on each side of the rows, and passing cords from one stake to another. By so doing he managed to limit the potatoes to a yard in width. The potatoes were lifted and weighed on August 20th, the produce being as above stated.

[Telegraphic Journal.]

SCIENCE.

THE words science and scientific men are amongst the most ill-used in the English language. We hear of the science of telegraphy, the science of photography, the science of steam, etc., and read of telegraph instruments, cameras, and steam-engines. A scientific man is supposed to be one who brushes his uncut hair back over his ears, wears spectacles on nose, and doesn't believe in the Bible. Science is considered analogous to scepticism, and a scientific man is regarded as a lost bore.

Now, what is science? It is *scientia* or knowledge. But what is knowledge? It is the acquaintance we make with things around us by means of our senses. All that we know is gained either by seeing, hearing, smelling, tasting, or touching. All that exists apart from ourselves has properties, qualities, and attributes—in other words, peculiarities and differences, which reach the mind by the different ways in which they affect the various senses. The senses are the roads which lead to the mind. The sun affects the eye, a thunderclap affects the ear, gas affects the nose, a black draught affects the taste, red-hot iron affects the touch. Different things affect the mind in different ways, and thus nature, by means of the senses, imparts to us knowledge. Particular facts appear to us in various ways, and thus constitute *phenomena*. The accumulation and comprehension of phenomena is knowledge, and thus knowledge implies the faculty of observation, the power of comparison, the gift of memory. Hence we must have the mind to observe and the thing observed. But the thing observed may be something more than that which directly affects the senses. It may be a hasty thought, a mental picture, a well-conceived law. Thus knowledge also implies reason; the power by which the mind groups together particular facts, and evolves from them propositions, laws, and general ideas. The power of generalization or of educing principles is therefore a species of knowledge above that power of gathering or accumulating the particular facts from which it is derived, and this universal knowledge is science. The employment of the senses accumulates facts, the memory stores up phenomena, the comparison of phenomena begets differences and similarities, and the mind produces uniformities, laws, and generalizations. Thus we have the power of obtaining knowledge and the results obtained—the one is scientific method, the other is scientific lore or knowledge. So that science and universal knowledge are synonymous terms. But science is knowledge methodically digested and systematically arranged, so as to concentrate the observations of the many within the comprehension of the few. It is the accumulation of universal truths from particular facts. And it is not confined to one series of facts or to one kind of phenomena. It has numerous branches. Thus the knowledge of the heavens constitutes the science of astronomy; the knowledge of the constitution of matter constitutes chemistry; of the affections matter, heat, light, and electricity constitute physics, of the motion of matter dynamics; the knowledge of the construction of the earth is geology, and of the properties of vegetable life botany; the knowledge of the mind is psychology, and that of thought logic. The accumulation of knowledge, or the power of generalization, is instinctive in the human mind; what is wanted is the power to classify and arrange. There are none so observant as children; but our system of education is so defective that no effort is ever made to cultivate this natural power and reduce observation to generalization. The senses are always employed in examining external phenomena, but the mind is rarely engaged in systematizing these observations. The grouping or arranging these observations in orders or classes, like a well-ordered library or a neatly arranged chest of drawers, is scientific method.

Thus a scientific man is one who examines facts in a methodical and systematic way, and it does not matter to what class of knowledge his reasoning is applied. Religion or language, history or politics, matter or force, may be so investigated, and invariably universal truths derived from particular facts constitute science.

The man who is engaged in simply manipulating a telegraph instrument is not a scientific man, but that man is one who observes all the changes and variations of the currents he uses, showing how all the changes and variations of resistance and insulation follow the variation and changes of the weather, and the numerous cosmical causes that interfere with the working of telegraphs. Science is therefore systematized knowledge.

INJURIOUS EFFECTS OF SNOW ON STEEL RAILS.

SOME interesting observations under this head are communicated from an Austrian line of railway, the Kaiser Ferdinand northern line. A portion of this line, about eight English miles in length, between Floridsdorf and Wagram, is very open, and often blocked with snow in winter-time. The obstacle is generally surmounted by strewing sand over the rails in front of the driving-wheels to increase their bite, and putting on extra steam. This portion of the line in question has a double line of metals, formed partly of Bessemer steel rails and partly of light Martin steel rails weighing about 30.50 kilogrammes per running metre. Now, the skidding of the wheels frequently caused heating of the tires and rails, which are suddenly cooled again by the low temperature of the air on the falling snow. This, in itself, must be injurious to the molecular construction of the metal. But, beside, the increased friction causes a certain amount of abrasion of the upper surface of the rails at the spot where the stoppages have occurred. Examinations proved that these abraded portions varied in length from 2 to 9 English inches in length, 1-12 to ¼ inch in depth, and extended over the whole breadth of the rail. A train, in passing over the depressions so caused, necessarily experiences a certain shock, and it is reasonable to suppose that the concussion thereby communicated to the rail will be most felt when the ground beneath is frozen hard, so that the natural elasticity of the rail has no room to play. In three instances rails so worn snapped asunder suddenly at the abraded portion, althougt no flaw or defect in the metal could be detected. This led to the removal of all abraded rails from this section of the line, amounting to twenty-eight lengths of Martin steel rails, and ten lengths of Bessemer rails. No similar case of fracture is known to have occurred in the iron or puddled-steel rails previously in use, although the amount of abrasion they underwent must have been at least as great. The inference is that the improved rails of Bessemer and other steel, their superior strength notwithstanding, are less capable of withstanding concussion than the older rails, and consequently whenever they are used, increased vigilance is requisite to prevent accidents in the winter-time.—*Zeitschrift.*

AN INFANT REVOLVER.

THE largest revolving gun that has probably ever been manufactured is now at the Royal Gun Factories in the Royal Arsenal, Woolwich, where it has been designed and constructed to assist the investigations which the Trinity Board are pursuing on the subject of fog-signals. It is a revolver with five chambers, firing successively through an open-mouth barrel, and moving about on a kind of truck. It weighs 35 cwt., and appears to be very ingeniously contrived. It will shortly be forwarded to Shoeburyness, there to undergo a series of trials in competition with various charges of gun-cotton. In order to increase the sound of this singular piece of ordnance, a large parabolic shield has been for some time at the butts in the Government marshes adjoining the Royal Arsenal, Woolwich, where all guns are sent for proof before being received into the service, awaiting that ordeal.

ENAMELLING METAL.—The use of colored enamels on large surfaces is yet in its infancy. The ordinary grey enamel (so called) is really not an enamel, but a transparent glaze, the apparent grey color of which is produced by the surface of iron beneath the glaze.

GREY MIXTURE ENAMEL.

	lbs.	ozs.
Sand	10	0
Red lead	33	0
Boracic acid	20	0
Cullett (broken glass)	114	0
Bicarbonate of soda	16	0
Nitre	1	2
Manganese	0	8½

GREY MIXTURE ENAMEL.

	lbs.	ozs.
Flint	36	0
Boracic acid	24	0
Bicarbonate of soda	24	0
Nitre	18	0

WHITE MIXTURE ENAMEL.

	lbs.	ozs.
Cullett	11	0
Boracic acid	7	0
Bicarbonate of soda	0	4
Phosphate of lime	3	8
Oxide of antimony	0	2

SULPHATE OF MAGNESIA IN COTTON FABRICS.—Dr. A. Frank, in a recent article on sulphate of magnesia (Epsom salts), which is at present obtained in Stassfurth, Germany, in large quantities from Keiserite, says that its principal application at present is in finishing cotton fabrics, especially in England. Its effect is to give to poor goods the feel and weight of heavier fabrics. For this purpose, goods are passed through concentrated solutions of the salt, and then gradually dried. Of course, goods thus treated become simply limp rags as soon as they are washed. If the Epsom salt used contains chlorine, the goods attract moisture from the air, and the fibre is seriously weakened and injured when they are passed over the hot drying rolls. Dr. Frank has examined some goods of this class, which lost 53 per cent in weight by being simply washed with distilled water.

THE DIRECTIONS AND VELOCITY OF WINDS.

THE issue of daily weather reports from Washington has familiarized the people of the United States with the subject of meteorology in some of its aspects. The United States signal-stations are furnished with apparatus by which wind currents, their directions and velocity, are observed, and, by the agency of the electric telegraph, recorded. The latest improvements are noted and adopted; and the Signal Service of the United States, in the interest of mariners, farmers, and the public generally, is nowhere exceeded for efficiency and accuracy.

La Nature gives an illustrated description of two new sets of apparatus—the one a self-registering vane, the other an "anemometer" (wind-measurer) with electrical connections. We subjoin engravings and descriptions, premising that these instruments vary in some particulars from the apparatus in use in the United States.

The vane is of the usual construction, and made of light sheet-copper. The form of the sheets differs according to taste, the object being that they shall be so disposed as to catch the lightest currents. The vane is balanced by a counter-weight, and is affixed at A to a spindle, or axis, which revolves in a hollow tube. The axis rests on its lower end as a pivot; and the utmost pains is taken to insure lightness, accuracy, and facility of movement.

The base of the spindle is inclosed in a box furnished with four metallic springs, to which are affixed wires, communicating with the telegraphic apparatus in the office of the observer. Four disks are attached to the spindle, and all

FIG. 1.—WEATHER-VANE PROVIDED WITH TELEGRAPHIC CONNECTIONS. SCALE, ONE TENTH OF THE ACTUAL SIZE.

four revolve with it; but only two can be in electric connection at the same time. These disks are shown on a larger scale at the left of the engraving, marked N. S. E. W. Their horizontal surface and outline is shown in the next engraving.

In the engraving the diverging lines represent the sixteen principal points on the compass-card, but on the disks these lines need not be drawn, as the disk itself is not referred to. Each disk presents in its outline a circle, and a segment of a larger circle, the segment being equal to six-sixteenths of the circle, and including seven of the sixteen points of the compass. When the protruding part of the disk comes opposite to the metallic spring, it touches and the circuit is closed. The pencil of the telegraph makes its mark. Taking the disks in the order of the engraving, we begin with the North. Starting at the compass-point, N.N.E., one telegraphic pencil touches the drum, and works alone, till N.N.W. is reached. We are going in our illustration "against the sun," and "boxing" all points of the compass. At N.N.W. (all the disks being in motion) the west disk (No. 2) closes the electric circuit, and two pencils record, until we reach W.N.W. when the circuit of the north disk is broken, and the west disk has the telegraph to itself.

At W.S.W. the south disk closes the circuit, and the west and south disks work together till we reach S.S.W., and there the west disk breaks the circuit, and the south disk operates alone till W.S.W. is reached, where the east disk comes in communication. South and east disks work together till E.S.E. is reached, and the east disk works alone up to E.N.E. where the north disk begins. Thence to N.N.E., where we started, two pencils are at work. It will be perceived that at the cardinal points, N., S., E., and W., and for one point on each side (two points if we count the whole 32) only one telegraphic pencil is at work. At the intermediate points two pencils record. Thus the directions of the air-currents are easily read, within a point or two. Greater accuracy might be reached by adding to the number of the disks and combinations. The apparatus in the United States Signal Offices does record with more closeness. The French electrical machine has, in connection with the vane, *four* recording cylinders, moved by clock-work. One cylinder is made to serve in the United States, both for the directions of the wind and its velocity. The weather-vane

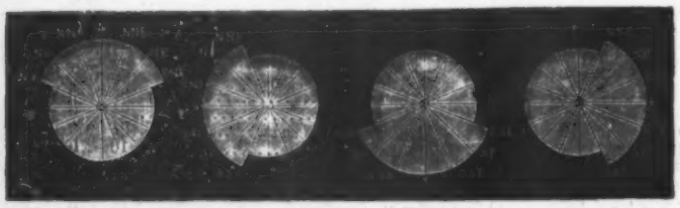


FIG. 2.—NORTH DISK. FIG. 3.—WEST DISK. FIG. 4.—SOUTH DISK. FIG. 5.—EAST DISK.

and the "anemometer" record by the same electric apparatus.

The feature of the "anemometer," introduced to public notice by Dr. Robinson, of Armagh, about forty years ago, is in the arrangement of four cups, A, B, C, D, at the end of the rods, and revolving with the wind, on a horizontal plane. It is said that Edgeworth suggested the employment of the cups, but to Robinson the credit belongs of applying them. A larger number than four has been experimented with; and still other forms of wind-measurers of velocity have been attempted, but experience has settled down upon the Robinson apparatus and the four cups. The concave side of the cup catches the wind, and the convex side presents the least resistance. Dr. Robinson computed that the speed of the cups in motion is one third of the speed of the wind; in other words, that the wind traverses three times the length of the circumference of the circle made by the cups in the same time. The loss in the speed of the cups is in the friction and resistance. The number three is convenient, and sufficiently exact, though the actual loss is computed to be a fraction less.

The rods to which the cups are affixed are of course fastened to the spindle, which, as in the case of the weather-vane, revolves also. E is the hollow tube in which it turns. G is a box or case containing the connecting apparatus by which the revolutions are recorded. This case is shown open in the next engraving.

In the box, G, is shown the spindle with an endless screw,

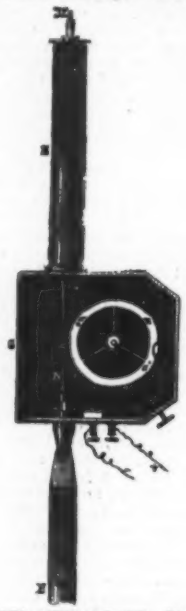


FIG. 6.—ROBINSON'S ANEMOMETER. SCALE, ONE TENTH.

at N, gearing into the wheel, R. This wheel is furnished with a hundred teeth, and each revolution of the screw advances the wheel one tooth. At *a a* are metalling pins, which, touching the spring S, close the electric circuit twice every time that the serrated or pinnated wheel goes round. Thus the revolution of the wheel represents one hundred revolutions of the axle. The more rapid the revolutions, the

FIG. 7.

greater the number of marks on the recording cylinder, and the shorter the space in which they are imprinted. A simple arithmetical calculation: multiplying the number of the revolutions of the axle by three times the length of the circle traversed by the cups, gives the speed of the wind. The velocity being ascertained, the weight or pressure of the wind current may be calculated by well-known rules.

[American Miller.]

PRACTICAL HINTS ON MILL-BUILDING.

By R. JAMES ABERNATHY.

IN mill building, or, to be a little more explicit, in the mechanical construction of mill machinery, the fitting of cog-wheels, as a general thing, occupies a very important place. It is something that has to be often repeated, and while, of course, the majority of millwrights know how the work should be done, and can do it correctly and neatly, still there are those that have the work to do, or wish to know how to do it well, who are not very well informed how to go about it. For the benefit of this class I propose to devote this article.

In fitting spur-wheels, there is but little trouble, as all the lines are parallel to each other; that is, the pitch lines, shoulder lines, key lines, etc. The principal thing the workman has to bear in mind, if he gets his cogs out by hand, is to have the body full enough to fill out in spacing and laying off. The shank must be neatly fitted into the mortice, as it is better to dress the cog to a fit than to force a fit by hammering, or by any other method. Forcing a fit is very apt to break the wheel, and does not make a neat and reliable job. It is much the better way to take the cog out repeatedly, when fitting it, than to force it in without accurate fitting.

After the cogs are all driven, dress out and drive keys as hard as you will, the harder the better, as there is but little danger of breakage in driving keys. It is just as essential, however, to dress the keys to a proper fit before driving as it is the cogs.

In cogging bevel wheels, the task is somewhat more difficult, as all the lines run to a common centre. In other respects, after the cogs are made, the process of fitting is substantially the same as in spur wheels. As is well known, the shafts on which bevel wheels are hung run at right angles with each other, and the common centre referred to is the point where the imaginary centres of these shafts cross each other. This centre must be established before the cogs can be cut off to the proper length, or the inside pitch line obtained. How this centre is to be found or fixed, depends upon circumstances in each case. Sometimes the wheel is on a long shaft, and in that case this shaft is in the way of fixing the centre, and then other arrangements must be made for running the lines to the centre; but if the wheel is off the shaft, and hung on a mandrel, a fixed centre can easily be established, and an ordinary straight edge can be used in laying out the lines.

When the wheels are fitted, the next thing in order is to get the diameter of the pitch line. To do this, the pitch line of the pinion must be carefully measured, and the diameter thus obtained is multiplied by the number of cogs in the wheel you have fitted, then divide by the number of teeth in the pinion, and the result will be the diameter of the pitch line required. Here is the

Rule.—Multiply the number of cogs in wheel by diameter of pitch line on pinion, and divide by number of teeth in pinion.

Example.—Required the pitch line diameter of a wheel having 108 cogs, 2½ pitch, gearing into a pinion having 36 teeth.

A pinion or wheel having 36 teeth, 2½ pitch, would have a diameter of 25.92 inches. Then, $108 \times 25.92 \div 36 = 77.76$. Thus the diameter required is 77.76 inches.

This rule is in common use for obtaining the pitch line, although there is quite a good deal of work about it.

In the case of a large spur-wheel, where there are two or more pinions gearing into it, the calculations should be made from each pinion separately if they vary in size, and the difference averaged, should there be any.

There is another rule which answers for general purposes just as well, namely:

Rule.—Multiply the number of cogs in the wheel by the number of thirty-seconds in the pitch as a decimal.

Example.—Thus, in a 2½ pitch there are 72 thirty-seconds, thus $108 \times .72 = 77.76$.

After having obtained the required diameter, the edges of the cogs must be dressed or turned off to suit, and the line carefully put on and then carefully spaced, and just as carefully laid off with a good pair of dividers. The line must then be carried over to the other edge of the cogs, and proceeded with as before.

The inside line on a bevel wheel is found by running a line from the outside pitch to the common centre referred to. On a spur-wheel the pitch line is carried over by running a line parallel with the shaft.

DETERMINATION OF MIXED OILS.

THE testing of mixed oils is far from being a certain operation. The following, however, are the principal means of determining the presence of mixtures.

1st. The determination of its specific gravity at 15° C. and its comparison with the following table:

	Density.	Degrees on alcoholometer.	Weight of 1 hectolitre.
Tallow oil (oleine)	900·3	73·0	88·40
Colza (winter strained)	915·0	59·8	91·50
" (summer ")	916·9	59·8	91·67
Rape-seed (winter strained)	915·4	52·5	91·54
" (summer ")	915·7	59·2	91·57
Groundnut (Arachis oil)	917·0	58·5	91·70
Olive	917·0	58·5	91.70
Almond	918·0	58·0	91·80
Beechnut	920·7	57·5	92·07
Sesame	923·5	56·0	92·35
Whale	924·0	55·0	92·40
Poppy	925·3	54·5	92·53
Hemp-seed	927·0	53·5	92·70
Cod-liver	927·0	53·5	92·70
Cotton-seed	930·6	52·0	93·06
Linseed	935·0	50·0	93·50

2d. Chlorine turns animal oils brown, and vegetable oils white. The former are soluble and the latter insoluble in ether.

3d. To discover an adulteration by oil of sesame, shake five grammes of sulphuric acid with five grammes of nitric, and ten grammes of the suspected oil; if mixed, a grass-green color is immediately developed.

4th. To find if olive oil is mixed with any unknown oil, mix fifty centimetres of the oil with ten centimetres of sulphuric acid. If the olive oil is pure, there will be a rise of 42°. If mixed, the temperature will be 58° for oil of colza; 65° for beechnut; 68° for sesame; 98° for hemp-seed; 13° for linseed.

5th. The production of a black hue in the lower part of the test tube, after agitating twenty drops of an alcoholic solution of nitrate of silver with ten grammes of oil and twenty grammes of ether, the flask being kept in the dark, shows the presence of rape-seed oil.

6th. The most difficult adulteration to be detected is that of olive and groundnut oil. These oils have the same density, congeal at the same temperature, and are acted on by sulphuric acid in a similar manner. They can, however, be distinguished as follows:

Dissolve cold twelve grammes of mercury in fifteen grammes of nitric acid of 38°. Mix this with ninety grammes of the suspected oil, and agitate often during two hours. If the olive oil is pure, the mixture will become homogeneous. If not, and especially if the mixture become filled with carboniferous streaks, the presence of the groundnut oil may be reported.—*Moniteur des Produits Chimiques.*

COLORING MATTERS OF GLASS.

IN a somewhat recent number of the *Moniteur Scientifique* appears a paper on the condition of the coloring matter in copper, ruby glass, and other similar glasses, by Paul Ebell. He concludes: First, certain metals, such as gold, silver, copper, and lead, may be dissolved as such by glass in fusion; secondly, gold, silver, and copper may thus be dissolved in two different molecular states, in only one of which do they color the glass; thirdly, that molecular state which gives color corresponds to the highest temperature and to the nascent condition of the metal; the non-coloring condition to lower temperatures and to the solid state of the metal; fourthly, coloring by baking is simply the passage from one of these states to the other by heating; fifthly, practically, this coloration is effected either by introducing the metal in its non-coloring condition, fusing at a high temperature, and producing the color by baking; or by applying the metal directly in the coloring condition with a pencil, and heating to a low temperature in a muffle; sixthly, by rapid cooling the metals dissolved as such solidify in their natural state; seventhly, by slow cooling the metal separates in different forms according to circumstances, but always pure; as a finely divided precipitate of microscopic crystals, or of crystals visible to the naked eye, as in aventurine glass; eighthly, gold, silver, and copper, in their optical properties, as well in the solid state as in solution, present the greatest analogy with both mineral and organic coloring matters, such as Prussian blue, indigo, aniline colors, murexide, etc.